

Dedicated three-player game

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Published by:

Milpitas, California 95036 Atari Games Corporation 675 Sycamore Drive P.O. Box 361110

Printed in the U.S.A.

12/90

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TAR RT NOTICE O N - A

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Use of non-Atari parts or modifications of any Atari game circuitry may adversely affect the safety of your game, and may cause injury to you and your players. You may void the game warranty (printed on the inside back cover of this manual) if you do any of the following:

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- All ground wires in the game are properly connected as shown in the game wiring diagram.
- The power cord is properly plugged into a grounded three-wire outlet.
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lem, please contact Customer Service at Atari Games you are still unable to solve the interference prob-Corporation. See the inside front cover of this manual for service in your area.

R MA W \mathbf{E}

The following safety precautions apply to all game operators and service personnel. Specific warnings and cautions will be found in this manual whenever they

WARNING

ommend you hire a licensed electrician to install a three-wire grounded outlet. If the control panel is not **Properly Ground the Game.** Players may receive an electrical shock if this game is not properly grounded! til it has been inspected and properly grounded. This game should only be plugged into a grounded three-wire outlet. If you have only a two-wire outlet, we recshock! After servicing any part on the control panel, check that the grounding wire is firmly secured to the To avoid electrical shock, do not plug in the game uninside of the control panel. After you have checked properly grounded, players may receive an electrical this, lock up the game.

AC Power Connection. Before you plug in the game, be sure that the game's power supply can accept the AC line voltage in your location. The line voltage requirements are listed in the first chapter of this manual.

cal shock, disconnect the game from the AC power before removing or repairing any part of the game. If Disconnect Power During Repairs. To avoid electriyou remove or repair the video display, be very careful to avoid electrical shock. High voltages continue to circuitry and the cathode-ray tube (CRT). Do not touch the internal parts of the display with your hands or with metal objects! Always discharge the high voltage connect it from the power source. First, attach one end of a large, well-insulated, 18-gauge jumper wire to Then momentarily touch the free end of the grounded jumper wire to the CRT anode by sliding the wire under the anode cap. Wait two minutes and do exist even after power is disconnected in the display from the CRT before servicing it. Do this after you disUse Only Atari Parts. To maintain the safety of your Atari game, use only Atari parts when you repair it. Using non-Atari parts or modifying the game circuitry may be dangerous, and could injure you and your

it breaks, it may implode! Shattered glass from the implosion can fly six feet or more. Handle the CRT With Care. If you drop the CRT and

Use the Proper Fuses. To avoid electrical shock, use replacement fuses which are specified in the parts list for this game. Replacement fuses must match those replaced in fuse type, voltage rating, and current rating. In addition, the fuse cover must be in place during game operation.

CAUTION

connectors on each printed circuit board (PCB) are properly plugged in. The connectors are keyed to fit Properly Attach All Connectors. Make sure that the only one way. If they do not slip on easily, do not force them. If you reverse a connector, it may damage your game and void your warranty.

rescent line ballast transformer will overheat and cause a potential fire hazard. Check the product identifica-Ensure the Proper AC Line Frequency. Video countries with 50 Hz line power (used in Europe). If a er (used in the United States) must not be operated in 60 Hz machine operates on 50 Hz line power, the fluogames manufactured for operation on 60 Hz line powtion label on your machine for the line frequency required

ABOUT NOTES, CAUTIONS, AND WARNINGS

In Atari publications, notes, cautions and warnings have the following meaning:

NOTE — A highlighted piece of information.

void the warranty on Atari printed-circuit boards, parts thereon, and video displays if equipment or parts are damaged or destroyed due to failure of following in-CAUTION — Equipment and/or parts can be damaged or destroyed if instructions are not followed. You will structions.

WARNING - Players and/or technicians can be killed or injured if instructions are not followed ∷∄

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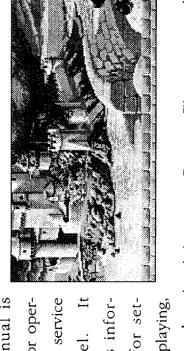
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CHAPTER

Set-Up

How to Use This Manual

personnel. It mation for set-This manual is provides inforting up, playing, ators and service written for oper-

testing, and maintaining your RampartTM tion. * Chapter 2 describes the self-test and three-player game. The manual is divided into the following chapters: * Chapter 1 contains set-up and game playing informa

tenance, repair, shooting procecontains maindures. Be sure to perform the preventive mainteand

for the Rampart game printed-circuit board tion. * Chapter 4 contains the parts illustranance tasks to keep the game in good condi-(PCB) and the Midi Trak-Ball coupler PCB, plus the game wiring diagram.

Inspecting the Game

WARNING

To avoid electrically shocking yourself and damaging the game electronics, do not plug in the game until it has been inspected and set up for your line voltage.

This cabinet should be connected to a grounded three-wire outlet only. If you have only two-wire outlets, we recommend that you hire a licensed electrician to install grounded outlets. Players can receive an electrical shock if the cabinet is not properly grounded.

Inspect your Rampart game carefully to ensure that the game is complete and was delivered to you in good condition.

Inspect the cabinet as follows:

- 1. Examine the exterior of the cabinet for dents, chips, or broken parts.
 - 2. Open the service door. Unlock and open the coin doors. Inspect the interior of the cabinet as follows:
- a. Check that all plug-in connectors on the cabiner harnesses are firmly plugged in. Do not force connectors together. The connectors are keyed so they fit only in the proper orientation. A reversed connector can damage a printed-circuit board (PCB). This will void your warranty.
- b. Ensure that all plug-in integrated circuits on each PCB are firmly plugged into their sockets.
- Inspect the power cord for any cuts or dents in the insulation.
- d. Inspect the power supply. Make sure that the correct fuses are installed. Check that the harness is plugged in correctly and that the fuse block cover is mounted in place. Check that the green ground wire are connected.

Table 1-1 Game Specifications

Characteristic	Specification
Power Consumption	127 (??) W maximum
Line Fuse Rating	3 Amps
Line Voltage	102 to 132 VAC
Temperature	5° to 38° C (37° to 100° F)
Humidity	Not to exceed 95% relative
Width	33.25 inches (84 cm)
Depth	38.25 inches (97 cm)
Height	71.75 inches (182 cm)
Weight	325 lbs. (148 kg)

e. Inspect other sub-assemblies, such as the video display, controls, printed-circuit boards (PCBs), and speakers. Make sure that they are mounted securely and that the ground wires are conserted.

Control and Switch Locations

Most of the controls are located inside the drawer, behind the control panel (see Figure 1-1). The only exception is the power on/off switch.

Power On/Off Switch

The power on/off switch is located at the top left of the cabinet (behind the peak).

Volume Control

The volume control is located on the Rampart game PCB, which is in the drawer behind the control panel.

Self-Test SwitchThe self-test switch is also located on the game PCB, in the drawer behind the control panel.

Coin Counter

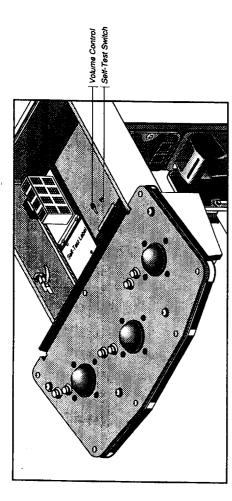
The coin counter is located on the bottom of the coin box, inside the lower coin door.

Installing the Control Panel

Make sure the game power is turned off. To install the separately packaged control panel, you need the following tools:

- Hex driver or wrench
- Four flat washers (provided with game)
- Four nut-washer assemblies (provided with game)

- Reach in through the openings on the front of the drawer, and open the spring draw latch on each side. Pull the drawer out partly. (See Figure 1-1.)
- . Hold the control panel up to the front of the drawer, and match up the four threaded studs with the four small holes (one in each corner). See Figure 1-2.
- 3. Install one flat washer and nut/washer assembly onto each threaded stud.
- 4. Plug the two control panel harness connectors into the game harness inside the drawer. These connectors are interchangeable, so be sure to match wire colors. Plug the ground wires together at the Faston connectors. This step is very important, since this wire grounds the control panel.
- 5. Close the drawer and snap shut both latches.



Set-Up

Figure 1-1 Location of Volume Control and Self-Test Switch

- furn on the game power. Check that the video display and the attraction lamp have power.
- 7. Observe the screen: you should see the attract mode displayed. If the screen remains a solid white, red, or blue color, you have a RAM failure. These failures are as follows:

Color RAM	Bit-map RAM	Motion-object RAM
White	Red	Blue

NOTE

The Rampart game does a short RAM test whenever you turn on the power. If you want to circumvent the solid white, red, or blue RAM failure screen and enter the self-test, push the self-test switch to the "on" position (to the right). Then turn the game power off and on again.

Setting the Coin and Game Options

The Rampart coin and game options are set in the self-test. Refer to Chapter 2 for the recommended settings and the procedure for setting the options.

Game Play

This section of the manual describes the theme of the Rampart game and the game play features.

Introduction

Rampart combines the best of strategy puzzle games with dynamite action and the excitement of head-to-head competition. Up to three players can play at once to see who becomes the medieval overlord.

Play Mode

In the first phase of game play, players select a site for their home castle and position their cannons. Then, it's on with the battle, as each side hurls projectiles to destroy enemy walls. Once the onslaught ends, the players must quickly rebuild and extend their walls before the next battle. The players must completely surround at least one castle in order to continue play.

In a multiple-player game, the contest is head-to-head for an operator-selectable maximum of number battles (the factory setting is for seven battles per game). As long as a player can place pieces to surround at least one castle, he continues. If a player is eliminated, he may deposit another coin to continue.

In a one-player game, the computer directs an invading armada against the player's castles. The objective is to establish a fort and expand your realm to the entire island. You must destroy the computer's fleet before they reach shore and move their cannons onto the land. In higher levels of game play, the computer cannon fire will leave behind burning rubble, preventing the player from repairing and extending his walls.

Rampart's action is lightning fast. The strategy is exhilarating. The thrill of head-to-head competition is intense

N O T E S

CHAPTER 2

Self-Test

INTRODUCTION

Use the Rampart self-test to check the condition of the game circuitry and controls. You will see the self-test information on the video display and hear the sound test information through the speak-

ers. You do not need any additional equip- order ment to perform the self-test. * You should lists a perform the self-test when you first set up the purpo

game, each time you collect the money, or when you suspect game failure.

This chapter shows the screens in the self-test and explains each of the tests. The screens and explanations are arranged in the

order they appear in the self-test. Table 2-1 lists all of the self-test screens and their purposes.

Rampart 3-Player Game Self-Test

Entering and Exiting the Self-Test

To enter the self-test, turn on the self-test switch on the game PCB. Exit the self-test by switching off the self-test switch.

Select Test Menu

menu, shown in Figure 2-1. Move up and down the list by rolling the Trak-Ball; the corresponding test is Choose which test or screen you want to see from this highlighted in white. Choose the screen by pressing the red PLACE button.

Statistics

the information on the Rampart statistics page in the back of this manual. The statistics are collected from the statistics by holding down the red ROTATE button and pressing the red PLACE button at the same time. the last time the statistics were cleared. You can clear Use the information shown on the statistics screen, in Figure 2-2, and on the histogram screens to keep track of your game use and maximize your profits. Record



Figure 2-1 Self-Test Menu Screen

Press the red PLACE button to leave this screen and go to the histograms.

- Left Coins show the number of coins counted in the left coin mechanism.
- Right Coins show the number of coins counted in the right coin mechanism.

Table 2-1 Summary of All Self-Test Screens

					lay. isplay. play.	e of red, blue, and green.
Use or Furpose	Displays the game statistics.	Use to set and check the game options settings. Use to set and check the coin options settings. Use to check the audio circuits. Use to test the player controls.	Use to check the video RAM. Use to check the color RAM. Use to check all RAM.	Use to check the program ROMs. Use to check the alphanumeric displays. Use to test the movement and color of game objects. Use to check the video display color circuits.	Use to check the red color purity in the video display. Use to check the green color purity in the video display. Use to check the blue color purity in the video display. Use to check the white color in the video display. Use to check the grey color in the video display.	Use to check and adjust video display convergence of red, blue, and green. Use to check and adjust video display convergence of red to blue
	Statistics Screen	veen n veen	RAM Test Screen Video RAM (looping) Color RAM (looping) All RAM (looping)	ROM Test Screen Playfield Test Screen Motion Object Screen Color Test Screen	Purity Test Screen Red Color Purity Screen Green Color Purity Screen Ulance Color Purity Screen White Color Purity Screen Corey Color Purity Screen Ulance C	Wbite Convergence Screen Violet Convergence Screen U

Rampart 3-Player Game

Self-Test

have errors counted for several weeks, replace the

EEROM at 38F.

	Stat	Statistics			
Left Coins	4.4	1533			
Right Coins		1838			
Aux Coins		0			
Idle Mins	* *	26085			
1 Player Mins		5677			
2 Player Mins	••	2272			
3 Player Mins	••	1009			
New Game Mins		9433			
Cont Game Mins	••	3872			
Left Pir Mins	••	4219			
Cotr Pir Mins	••	5964			
Right Pir Mins		3112			
Active Mins		9487			
Total Games		2624			
Total Sessions		730			
1 Pl Beginners		371			
1 Pl Advanced		150			
Error Count		6			
Total Coins		3371			
Avg Time/Coin	.••	236 secs	SS		
Percentage Play	••	2 6			
HOLD RED ROTATE AND PRESS RED PLACE	EAN	ID PRES	E 92	PLACE	
110 OL	AR	TO CLEAR STATISTICS	<u>છ</u>		
PRESS RED PLACE BUTTON FOR NEXT SCREEN		SS RED PLACE BUT FOR NEXT SCREEN	NO E z		

Figure 2-2 Statistics Screen

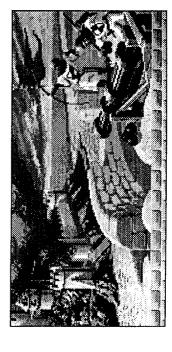
- Aux Coins shows the number of coins counted on the auxiliary coin input.
- Idle Mins shows the number of minutes the game was not being played.
- 1 Player/2 Player/3 Player Mins is the number of minutes the game was played by one, two, or three players.
- New Game Mins is the amount of time the game is played before continuation.
- Cont Game Mins is the amount of time the game is played during "add-a-coin" (continuation).
- Left/Cntr/Right Plr Mins is the number of minutes the game was played at the left, center, and right player stations.
- Active Mins is the number of minutes the game was being played in any mode.
- Total Games is the number of games played (one game per player).
- Total Sessions is the number of sessions played. For example, one 3-player game counts as one session.
- 1-Pl Beginners is the number of 1-player beginner games played.
- 1-Pl Advanced is the number of 1-player "veteran" games played.
- Error Count shows the number of errors counted in the erasable memory. If you have an error count, the statistics may be wrong. If you consistently

Aug Time/Coin is the average number of seconds Percentage Play is the amount of time, as a percentage, that the game is played while it is pow-Check and select the coin options on this screen, To move through the options, roll the Trak-Ball up or down. Change the option in yellow type. The factory GAME OPTIONS RESTORE FACTORY OPTIONS? Game Options shown in Figure 2-3. played per coin. ered on.

PRESSING RED ROTATE
RESTORES ORIGINAL SETTING
PRESS RED PLACE BUTTON
TO SAVE THIS SETTING AND EXI ADDITIONAL ROUNDS AFTER ADD-A-COIN 4 BATTLES AUTO-RESET HIGH SCORES ON NO CLEAR HIGH SCORES ON GAME DIFFICULTY: MEDIUM LENGTH OF 2 OR 3 PLAYER GAME:

Figure 2-3 Game Options Screen

nal setting, although you have changed it, press the red ROTATE button. This brings back the original setdefault settings are shown in green. To change a setting, roll the Trak-Ball right or left. To save the new settings, press the red PLACE button. This returns you to the select test screen. If you want to keep the origiting. Use the red PLACE button to exit. The game option settings with factory defaults are shown in Table 2-2.



2-3

Self-Test Rampart 3-Player Game

Table 2-2 Game Option Settings

Option	Settings	sguj	Explanation
Restore Factory Options	Yes	No V	Lets you set all the game options to the factory options or lets you use your own settings. Make sure you set this to no to use your own chosen settings.
Clear High Scores	Off	On 🗸	Lets you clear the high score table.
Game Difficulty	Easy Hard	Medium 🗸 Very Hard	Pre-programmed obstacles and more enemy cannons being fired contribute to increased difficulty.
Length of 2- or 3-Player Game	5, 7	5, 7 v , 10, 15 battles	Lets you adjust the maximum number of rounds (battles) allowed for multi-player games.
Additional Rounds After Add-a-coin	2, 4 🗸, 6, 8	6, 8	Lets you adjust the additional number of rounds (battles) after an add-a-coin in multi-player games.
Auto-Reset High Scores	Off) 00	Automatically resets the high scores to the factory defaults after 2000 games, unless a player has entered his initials within the previous 200 games.
✓ Manufacturer's recommended settings. These settings are shown in green on the screen.	d settings. The	ese settings are sho	wn in green on the screen.

Coin Options

Check and select the coin options on this screen, shown in Figure 2-4.

To move through the options, roll the Trak-Ball up or down. Change the option in yellow type. The factory default settings are shown in green. To change a setting, roll the red Midi Trak-Ball right or left. To save the new settings, press the red PLACE button. This returns you to the select test screen. If you want to keep the original setting, although you have changed it, press the red ROTATE button. This brings back the original setting. Use the red PLACE button to exit.

The coin option settings and factory defaults are explained in Table 2-3.

```
FREE PLAY:
NO
GAME COST:
1 COIN 1 CREDIT
BOUUS FOR QUANTITY BUY-IN:
NONE
RIGHT MECH VALUE:
1 COIN COUNTS AS, 1 COIN
LEFT MECH VALUE:
1 COIN COUNTS AS 1 COIN
LEFT MECH VALUE:
1 COIN COUNTS AS 1 COIN
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Figure 2-4 Coin Options Screen

2-4

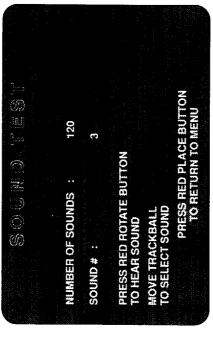


Figure 2-5 Sound Test Screen

Sound Test

The sound test indicates the condition of the sound effects circuit on the game PCB. The sound test screen appears in Figure 2-5.

Use the Trak-Ball to select the sound and press the red ROTATE button to listen to it. Pressing the red PLACE button returns you to the select test menu

Controls Test

The controls test screen is shown in Figure 2-6. Test the coin mechanism switches, control panel buttons, and Midi Trak-Balls. As you use the control, the red control name changes to yellow on the screen. If the name does not change to yellow, check the connections, switches, and mechanism. *Ignore the "RIGHT PLACE ALT" and "RIGHT ROTATE ALT" screen dis-*

Rampart 3-Player Game

Self-Test

Table 2-3 Coin Option Settings

Option Sc Free Play No ✓ Discount to Continue No ✓ Game Cost 1 coin 2 coins 2 coins	Settings	Explanation
o Continue	Voc	
o Continue	S	Set this to "Yes" for demonstrating the game.
	Yes	Lets you offer a reduced price per credit when players want to continue a game.
	1 coin 1 credit 🗸 2 coins 1 credit	Sets the number of coins required for one credit.
& COINS	 8 coins 1 credit	
Bonus for Quantity Buy-in None V		Lets you choose various levels of bonus coins or no bonus.
2 coins 3 coins		
5 coins 4 coins	coins give 2 (extra coins) coins give 1 (extra coin)	
4 coins		
4 coins		
5 coins	coins give 1 (extra coin)	
5 coins	_	
6 coins	_	
6 coins		
6 coins		
7 coins		
7 coins	coins give 2 (extra coins)	
Coins	coins give 5 (extra coins)	
8 coins	coins give 2 (extra coins)	
8 coins	coins give 3 (extra coins)	
9 coins	coins give 1 (extra coin)	
9 coins	coins give 3 (extra coins)	
Right Mech Value 1 coin	coin counts as 1 coin 🗸	Is the number of coins each coin counts as in the
:		right coin mechanism.
8 coins	8 coins count as 1 coin	
Left Mech Value 1 coin	1 coin counts as 1 coin 🗸	Is the number of coins each coin counts as in the
8 coins	8 coins count as 1 coin	left coin mechanism.
✓ Manufacturer's recommended settings. These settings are shown in green on the screen.	ings. These settings are	shown in green on the screen.

PHESS BUTTONS AND MOVE TRACKBALL
RIGHT PLACE ALT
RIGHT PLACE SW
RIGHT COIN SWITCH
LEFT COIN SWIT

Complete RAM Test

and harnesses for that direction of movement.

plays: they are not applicable to this game. Simultaneously press the red ROTATE and red PLACE buttons to return to the test select screen.

Moving each Trak-Ball causes the yellow hexadecimal numbers to change when you roll it up and down (UP/DN) or left and right (LT/RT). Use these numbers

to help correctly orient the Trak-Ball, if you are installing a new one. If the numbers on the screen do not change, check the optical coupler PCBs, connectors,

Use this selection screen, shown in Figure 2-7, to choose which RAM test you want to perform. Use the different tests according to Table 2-4.

Figure 2-6 Controls Test Screen

Self-Test Rampart 3-Player Game



Figure 2-7 RAM Test Menu

If you get an error in any of the RAM tests, see Table 2-5 for more information. If you have serious RAM problems, you may see only a colored screen.

Press the red PLACE button to leave the individual RAM test and return to the RAM test menu screen. Press the red PLACE button once more to return to the test select screen.

Complete ROM Test

The ROM test screen is shown in Figure 2-8. The 0K information appears. If the game has no ROM errors, you see the message *ALL ROMS are OK*.

If the game does have ROM errors, the ROM test screen will remain until the ROM error information is complete. Press the red PLACE button several times to pass the ROM errors. The ROM error test takes a few seconds.

1 - VOC		TAPE		1-NOC	037E	
40K-H	: :	E4BF		40X-1-	EFBE	
80K-H	H.	9E7F		80K-L	4C7E	
COK-H	H.	DE3F		COK-L	2B3E	
		ALI	ALL ROMS ARE OK	RE OK		
	HOL	D RED PI	ACE TO P	HOLD RED PLACE TO PASS BAD ROWS	SMC	
		RELEASI	TO TEST	NEXT ROM		
		os:	17DEC1990	1 18:32:03		
		MAIN:	17DEC1990	09:51:50		
		PRESS	RED PLAC	PRESS RED PLACE BUTTON		
		TO F	TO RETURN TO MENU	MENU		

Figure 2-8 Complete ROM Test Screen

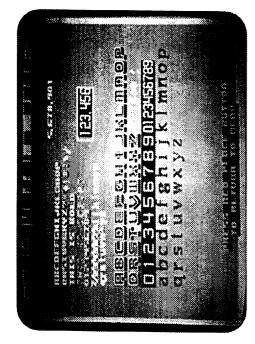


Figure 2-9 Playfield Test Screen

See Table 2-6 for the locations of the ROM errors. Press the red PLACE button to return to the test select screen.

Playfield Test

This test, shown in Figure 2-9, checks the condition of the bitmaps in the game. If you see an error on the screen, this indicates an error with the bitmap display

Table 2-4 When to Run the RAM Tests

Dryhlom		Location of
	Type of test	NAMES ICSICAL
Playfield is erratic or	Bitmap RAM* 8	8H, 9H, 10H,
looks wrong		and 11H
Motion objects are not	Motion object	5N, 6N
working properly or	RAM	
game play is erratic.		
Colors look wrong.	Color RAM	4н
*Bitmap RAM (once only) is a thorough test, and takes about	is a thorough test, an	id takes about
I minute to run. The "half" tests are significantly faster, but	f" tests are significan	tly faster, but
may not find all types of errors.	rrors.	
		-

Table 2-5 Bad RAM Locations by Error Address

True of DAM	A 44	RAM	Party Dite
type or resur	SCOTTONE .	LACALIOII	Data Dits
Playfield RAM	200000 to	11H	6-7
	21FFFF	10H	4-7
		H6	8-11
		8H	12–15
Motion Object	3E0000 to	N9	7-0
RAM	3E3FFF	N N	8–15
Color RAM	3C0000 to 3C07FF	4H	8-15
	1		

Rampart 3-Player Game

Table 2-6 Bad ROM Locations by Error Address

tion		. •	
ROM Location Low	ttion*: 13H/J 13H/J 13K 13L	15N fguration ' 13H/J 13K	13K 13K 13K
Error Address	24 Configura 0K-L 20K-L 40K-L 80K-L	COK-L 2x4096 Cony OK-L	40K-L 80K-L COK-L
ROM Location High	Program ROM 8x1024 Configuration*: 13H 0K-L 13 13H 20K-L 13 1 13J 40K-L 1 1 13K/L 80K-L 1	CUK-H 15M CUK-L 15N Program ROM 2x512 and 2x4096 Configuration* ; OK-H 13H OK-L 13H/J	133 133 134
Error Address	0K-H 20K-H 40K-H 80K-H	COK-H Program 0K-H	40K-H 80K-H C0K-H

The second secon

If you bave 8x32-pin ceramic parts in column 13 on your Rampart Game PCB, you bave an 8x1024 configuration. If you bave 2x28-pin ceramic parts and 2x32-pin plastic parts in column 13 of this board, you bave a 2x512 and 2x4096 configuration.

circuit. Press the red PLACE button to go to the test select screen.

Motion Object Test

The motion object test screen, shown in Figure 2-10, tests the movement and color of various game objects. Select the test function with the left ROTATE button. Use the Trak-Ball to move objects, change pictures, change object size, change object palette, and to toggle the horizontal flip. If there is an error, check the motion object ROM at 2N; also check the motion object RAM at 5N and 6N (see the RAM test above).

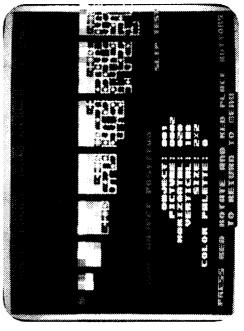


Figure 2-10 Motion Object Test Screen

Press the red PLACE button to move to the next object. Simultaneously press the red ROTATE and red PLACE buttons to go to the test select screen.

Self-Test

Color Test

This test indicates the dynamic range of the video display color circuit. The screen is shown in Figure 2-11. The left side of the screen should be black, with a grey scale changing to white in the middle. The right half of the screen should be red, green, and blue from top to bottom, each with a color scale from dark to bright, left to right.

If the screen does not match this description, adjust the video display as described in the video display manual.

Return to the test select screen by pressing the red PLACE button.

Color Purity Test

The color purity test has five screens. Each screen is a solid rectangle of color. The first screen is red. The other screens, which you can see by pressing the left ROTATE button, are green, blue, white, and gray.

These screens show the adjustment of the color punity of the video display. Each screen should display a rectangle of color, with no curving at the corners, no unevenness of color, and no lines in the display.

If the screens are not correct, adjust the video display as described in the video display manual.

Return to the test select screen by pressing the red PLACE button.

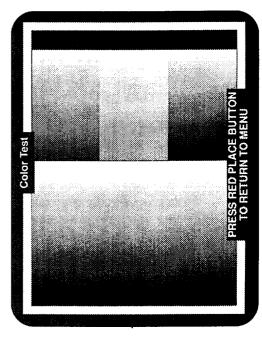


Figure 2-11 Color Test Screen

Self-Test Rampart 3-Player Game

Convergence Test

The convergence test has three screens: first white, then violet, and finally green. The white screen is shown in Figure 2-13. To see the violet and green screens, press the left ROTATE button. Press the red PLACE button to go to the test select screen.

Check the following on the screens:

- The grid lines should be straight within 3 mm, and the lines should not pincushion or barrel.
- The convergence of the lines on the violet and white screens should be within 2 mm.

If these screens do not meet these criteria, adjust the video display as described in the video display manual.

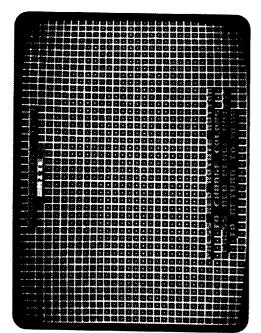
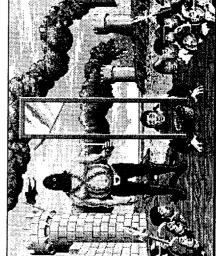


Figure 2-12 Convergence Test Screen

CHAPTER 3

Troubleshooting and Maintenance

This chapter contains troubleshooting tables and repair procedures for your RampartTM game. The chapter has two parts. The first part contains three troubleshooting tables. The tables contain



general troubleshooting information, the voltage levels and test points on the game print-

ed-circuit board, and a list of ROM-caused problems, with specific ROMs to check and replace. The last part of the chapter has information about connecting the video display if it requires separate posi-

Trak-Ball control assembly.

tive sync and repair information for the Midi

Troubleshooting and Maintenance

Rampart 3-Player Game

Table 3-1 Troubleshooting Table

Cotin Mechanism Problem 1. Check the wiring to the e side of the mechanism. 2. Check the voltage to the + side of the mechanism. 3. Trast the coin mechanism with the sound test screen in the self-test. 1. Check the voltage to the + side of the mechanism. 3. Check the voltage to the publicated with the council specific ROM problems. 4. Check the voltage to bubficated with the cornect type of lubricand If not, lubricant as shown in Figure 4. 5. Check the harmesses and connectors. 5. Check the harmesses and connectors. 6. Check the harmesses and connectors. 7. Check the voltage on the pants on the control are in good repair. Repair or replace parts. 7. Check the voltage on the JAMAM, connected? 7. Check the voltage on the JAMAM connectors. 8. Check the voltage on the JAMAM. 7. Is the game turned on? 8. Check the voltage on the JAMAM. 8. Streen is dark. 8. Is the game plugged in? 8. The game turned on? 9. Are the connectors on the life filer and transformer good? 9. The the men plugged in? 9. Are the connectors on the life filer and transformer good? 9. The the filer beyond the voltage on the life filer and transformer good? 9. The the display puglitheses turned up? 9. Are the connectors on the life filer and transformer good? 9. The the display puglitheses turned up? 9. Are the voltage sourced up. 9. Are the voltage to the voltage to the video display? 9. Are the voltage in the voltage to the video display? 9. Are the voltage in the voltage to the video display? 9. Are the voltage levels to connect power voltage is 100 VAC on 110 VAC, depending on the type of video display? 9. Are the voltage levels to connect power voltage is 100 VAC on 110 VAC, depending on the type of video display? 1. The video display wires onnect power voltage to the video display? 1. The the voltage levels to the voltage to the video display of the video display in th	1. Check the wiring to the coin mechanism. 2. Check the voltage to the + side of the mechanism. 3. Test the coin mechanisms with the sound test screen in the self-test. 1. Check the harness and connectors. 2. Perform the self-test. 3. Check the voltage levels on the PCB. See Table 3-2, Voltage Inputs and Test Points. 4. Check What ROM Problems Look Like, Table 3-3, for specific ROM problems. 1. Has the Trak-Ball been lubricated with the correct type of lubricant? If not, lubricate it as shown in Figure 4-2. 2. Check the harnesses and connectors. 3. Check the optical coupler PCBs on the control. 4. If you took the control apart. have you reassembled it correctiv?
### ##################################	test. uts and Test Points. M problems. ant? If not, lubricate
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	vertical yoke wires on the display.
or color problems	lf-test to adjust the video display. Use the adjustment display manual
7	
Picture is not centered. Use the centering procedures in your video display manual.	ures in your video display manual.

Repairing the Video Display

The video display frame in this game is designed to be used with both horizontal- and vertical-mounting displays, as well as 19- and 25-inch displays.

Removing the Video Display

If you have a problem with the video display, first run the self-test procedure to narrow down the cause. To

make adjustments to the video display, unlock the service door on the rear of the cabinet.

If you want to repair the video display, remove it from the game by following this procedure: 1. Turn the game power off and wait two minutes. Unplug the power cord for safety.

Rampart 3-Player Game

Troubleshooting and Maintenance

Table 3-2 Voltage Inputs and Test Points on the PCB

Voltage	Test Point or LED	Source and Purpose
+5 ± 0.25 VDC	+5V1	Logic power from the switching power supply.
•	CR8 LED	Lights when 5 V is applied to the PCB and the reset (RST) jumper is open.
	CR5 LED	Lights when the +12 V supply is good.
	CR4 LED	Lights when the −5 V supply is good.
+12V	+V0P (pin 4 of LM324)	+12 V from the switching power supply. Positive supply for the analog circuitry.
-5v	-V0P (pin 11 of LM324)	-5V from the switching power supply (if connected). Negative supply for the analog circuitry.

Table 3-3 What ROM Problems Look Like

Problem	ROM Causing the Problem	Check the ROM at:	
Program works, but the motion object is wrong.	Graphics	ZN	
Garbage on screen; program doesn't work. or game program is erratic.	Processor Program ROM 0	13C 13H, 13K/L	
No sound or erratic sound.	Audio ROM: Audio ADPCM	2D, 1D	

- 2. While you wait, unlock the top service door on the rear of the cabinet.
- 3. Remove the three screws that attach the attraction shield retainer, and remove retainer, shield, and attraction film. Then remove the display shield, cardboard bezels, and cleats in front of the display.

Consultation of the

WARNING

High Voltage

The video display contains lethal high voltages. To avoid injury, do not service this display until you observe all precautions necessary for working on high-voltage equipment.

X-Radiation

This video display is designed to minimize X-radiation. However, to avoid possible exposure to soft X-radiation, never modify the high-voltage circuitry.

Implosion Hazard

The cathode-ray tube (CRT) may implode if struck or dropped. The shattered glass from the tube may cause injury up to six feet away. Use care when handling the display and when removing it from the game cabinet. Also, wear gloves to protect your hands from the sheet-metal

- Remove the four nuts and washers that secure the video display.
- 5. Discharge the high voltage from the cathode-ray tube (CRT). The display assembly contains a circuit for discharging the high voltage to ground when power is removed. However, to make certain, always discharge the display as follows:
- a. Attach one end of a solid 18-gauge wire to a well-insulated screwdriver or wooden handle.
- b. Attach the other end of the wire to an earth ground.
- c. Quickly touch the blade end of the screwdriver to the CRT anode by sliding it under the anode cap.
- d. Wait two minutes and repeat part c.
- 6. Disconnect the harness connectors from the video display.
 - Pull the video display assembly out of the cabinet. Be extremely careful.

Replacing the Video Display

Perform the following procedure to replace the video display in the cabinet.

- 1. Carefully lift the video display into the cabinet.
- 2. Install the nuts that hold the video display assembly.

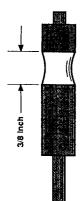


Figure 3-1 Excessive Shaft Wear

- Connect the power and signal harnesses to the video display
- the brightness, size, and centering as described in the video display service manual. Check the purity and convergence according to that manual, but ad-If you replace the CRT and yoke together, adjust just both only if required,
- Install the video display shield, bezel, and cleats. Replace the attraction film, shield, and retainer.
 - 5. Lock the rear service door on the cabinet.

Midi Trak-Ball Control

sists mainly of inspecting the roller shafts for excessive Routine maintenance of the Midi Trak-Ball control conwear and periodically lubricating the bearings.

Removing the Midi Trak-Ball

- 1. Open the control panel, and disconnect the harness at the six-pin connector.
- Remove the four nuts and carriage bolts that secure the Midi Trak-Ball assembly to the control panel.

Disassembling the Midi Trak-Ball

that secure the upper and lower frames (see Figure moved from the control panel, remove the six screws 4-3). Lift off the upper frame. The Midi Trak-Ball can To disassemble the Midi Trak-Ball after it has been renow be disassembled.

Inspecting the Midi Trak-Ball

- roller shafts and the idler shaft for excessive wear (see Figure 3-1). If the wear band exceeds 3/8 inch, replace the roller shaft as described in steps 1. With the Midi Trak-Ball disassembled, inspect the 2-6, or replace the idler shaft as described in steps
- To replace a roller shaft, first remove the roller shaft from the lower frame. ci
- Remove the metal encoding wheel by loosening the socket-head screw, flat washer, and split-lock washer. Remove the encoding wheel and bearings.
- Remount the bearings and encoding wheel on a new roller shaft. 4.

- screwdriver through the hole in the shaft. Tighten the socket-head screw with an Tighten the encoding wheel by inserting a 1/8inch-diameter pin or Allen wrench.
- Reinstall the roller shaft in the lower frame.
- idler To replace the idler shaft, first remove the shaft from the lower frame.
- idler Remove the bearings from the ends of the
- Remount the bearings on a new idler shaft. 10. Reinstall the idler shaft in the lower frame.

Lubricating the Midi Trak-Ball

Lubrication of the Midi Trak-Ball assembly should be performed every three months or 6,000 credits (as counted on the coin counter). To lubricate, place two drops of a light-duty oil, such as 3-In-One oil, on each of the six ball bearings shown in Figure 4-2

The state of the s

Replacing the Coupler PCB

- To remove the Coupler PCB, first disassemble the Midi Trak-Ball. Lift the PCB out of its slot. Carefully disconnect the red connector and remove the PCB.
- To reinstall the Coupler PCB, place the PCB in the slot in the lower frame, and reconnect the red con-

NOTE

make sure that the metal encoding wheel is not bent or damaged. Be sure the encoding wheel turns freely between the two halves of the radial optical coupler. When you reinstall the Coupler PCB

Reassembling the Midi Trak-Ball

- Install the upper frame of the Midi Trak-Ball over the assembly. Be sure that each Couple PCB is engaged in the slots of the upper frame
- Replace the six screws that secure the upper and lower frames together.
- Remount the Midi Trak-Ball assembly to the control panel using the four nuts and carriage bolts. જ
- Reconnect the six-pin connector of the harness.

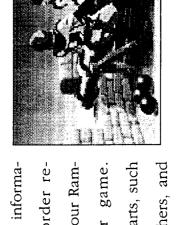
ROMs and RAMs

If you have think you have bad ROMs or RAMs, preform the ROM or RAM test in the self-test. If you have a ROM problem, see Table 3-3.

\approx ш ۲ Д ¥ H \circ

arts Illustration

Common hardware parts, such This chapter provides informaplacement parts for your RampartTM three-player game. as screws, nuts, washers, and tion you need to order re-



and correctly. We hope this

will create less downtime and

more profit from your games.

and the serial number of your

game. With this information,

we can fill your order rapidly

so on, are included in these parts illustrations. * When you order parts, give the part num-

ber, part name, the number of this manual,

bers are listed on the inside front cover of Atari Games Customer Service phone num-

this manual

Parts Illustrations

Rampart 3-Player Game

Parts Illustrations

170003-001
18: 15W Fourescent Light
1906-001
Fourescent Lamp Fixture
178015-110
#10.x 56* Pan-Hd. Screw
(2 places)
Lamp Retaining Clip
(2 places)

046925-01 Lower Retainer 176019-212 #8 x 3/4" Sq. Dr. LPW Screw

046929-01 178263-1202 Glass Retainer 3,4" x 1/8" 75-3816D Vinyl Foam Tape #8-32 x 1" FIL Screw (3 places)

A047011-01 Speaker Panel Assy. 176019-220 #8 x 1 1/4" Sq. Dr. Screw (4 places)

046928-01
Attraction Shield
048453-02
Attraction Film

| 178056-002 | 1/2" W., | 1 1/16" Foam Tape

048459-01 Cti Panel Backup 048472-01 Control Panel 048451-02 Cti Panel Decall

A048464-01
Cu Panel Assy.
175014-3059
Flat Washer
(4 places)
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Figure 4-1 Cabinet-Mounted Assemblies A048470-01 B

A047606-03 Power Supply Assy.

Ctt. Mounting Bracket (4 places) 176015-110 #10 x 5/8" Pan-Hd. Screw (8 places)

Self-Test Label

75-07002 1/4" Wide Pattern Washer (4 places) 75-045S #1/4 Spit Lock Washer (4 places) 72-5532 #1/4-20 x Z Hex Hd. Bott (4 places)

A048465-01 Control Pod Assy.

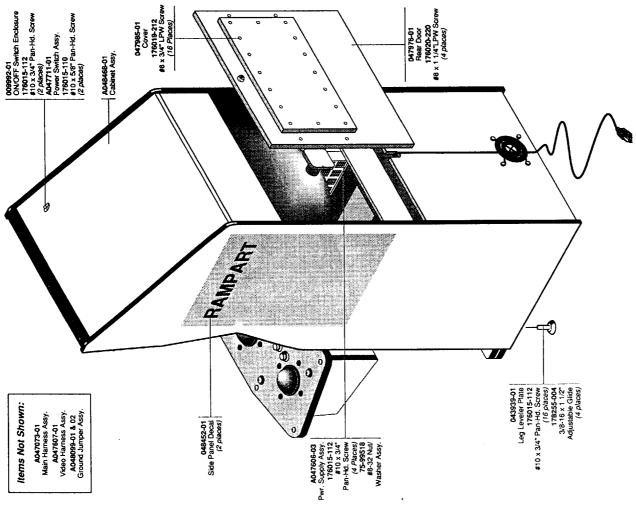


Figure 4-1 Cabinet-Mounted Assemblies A048470-01 B

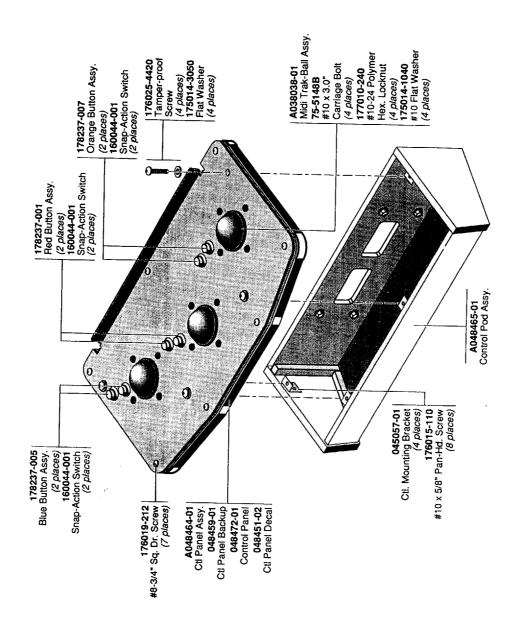


Figure 4-2 Control Panel Assembly A048464-01 B

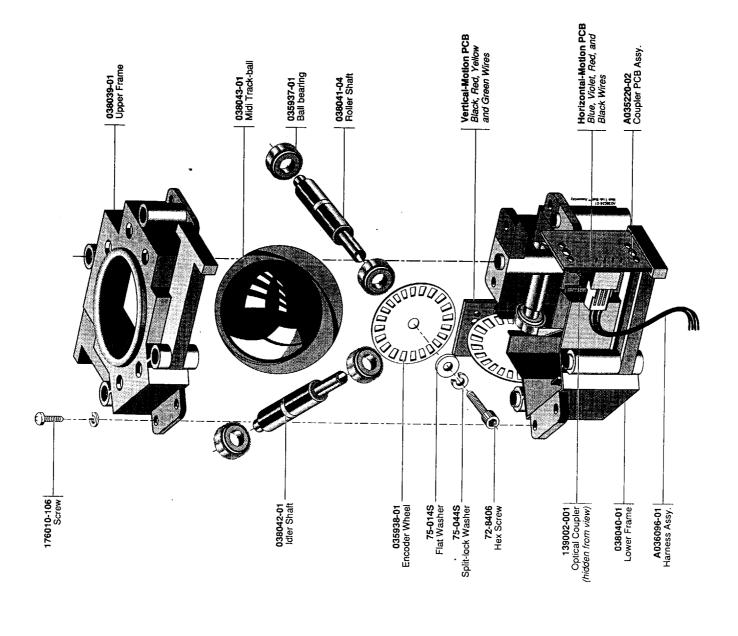


Figure 4-3 Midi Trak-Ball Assembly A038038-01 F

Parts Illustratrations

Figure 4-4 Coin Controls, Inc. Coin Door Assembly 171093-001

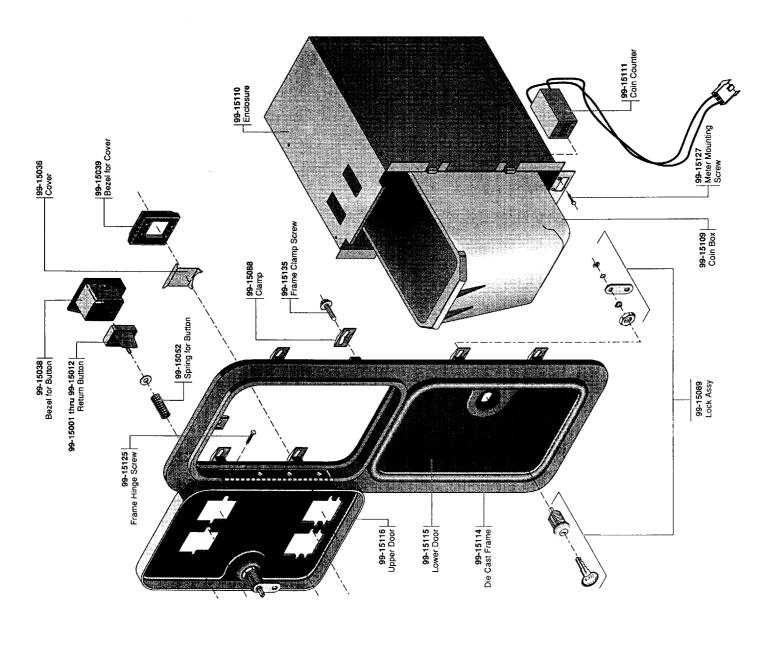


Figure 4-4 Coin Controls, Inc. Coin Door Assembly 171093-001

Parts Illustratrations

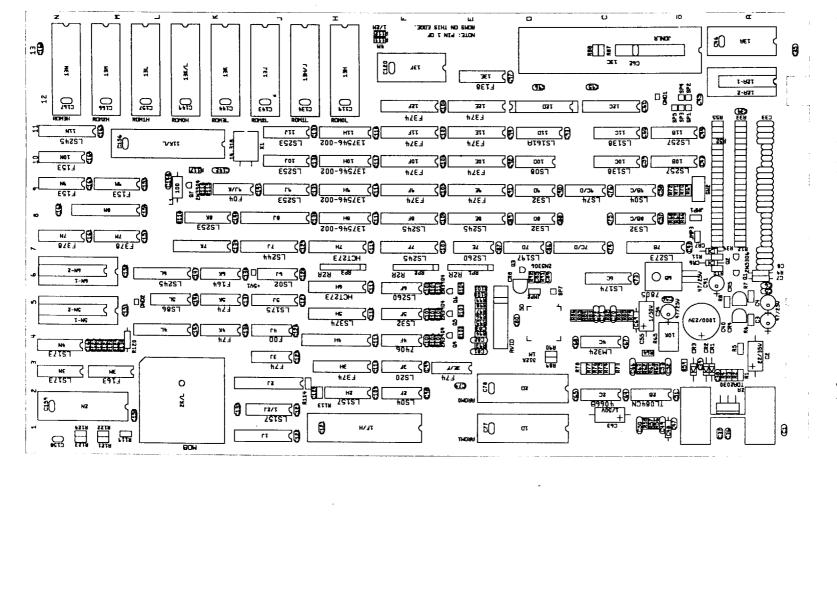
Parts Illustrations

A048494-01 P.S. Ground Jumper Assy.

79-15021001 2-Pos. Terminal Block 72-HA4986S #8-32 x 3/8" Cross-Rec Sorew (2 places) A043367-02 Jumper Assy. (BK, 6")

046924-01 Pwr Supply Chassis Base

149014-001 Switching Pwr Supply. (51, 74) 72-HA4806S #8-32 x 3/8" Cross-Rec Screw (3 places) \wedge



A047728-02 Jumper Assy. (W, 6")

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A047728-01 Jumper Assy. (BK, 6")

> **043908-01** Pwr Supply Label (*Fuse F1*)

142053-001 Isolation Transformer (120V, 1.5A) 72-HA4806S #8-32 x 38" Cross-Rec Screw (4 places)

Buw

179225-2201 1 Pos. Fuse Block 146008-3022 Slow Blow Fuse (250V, 34) 72-HA4666S #6-32 x 38° Cross-Rec Screw

A047728-01 Jumper Assy. (BK, 67)

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Figure 4-5 JAMMA Power Supply Assembly A047606-03 E

Figure 4-6 Rampart Game PCB Assembly (3-Player Version) A048868-01 D

Rampart Game PCB Assembly (3-Player Version) Parts List

Desig- nator	Description	Part No.	Desig- nator	Description	Part No.
2	Socker 32 Pin. 600-Inch	179257-032	4F	Integrated Circuit, 7406	137052-001
1F/H	Socker 40 Pin. 600-Inch	179257-040			
11/11	Socket, 20 Pin, .300-Inch	179259-020	4H	Integrated Circuit, RAM, 2Kx8 s,	
2D	Socket, 32 Pin, 600-Inch	179257-032		35 nsec	15/554-001
}			4J	Integrated Circuit, 74F00	137327-001
71	Socker, 24 Pin. 300-Inch	179259-024	4K	Integrated Circuit, 74F74	137436-001
2K/I	Socket 84 Pin. Plcc	179237-084	4L	Integrated Circuit, GAL16V8	136082-1001
1 7 7	Socket 32 Pin 600-Inch	179257-032			
77.7	Socket, January, 300 men	179259-024	4N	Integrated Circuit, 74LS173	137529-001
Ľ.	SOCKEL, 24 FILL, SOUTHIELL		7. Y	Integrated Circuit, 74LS32	137019-001
		000	71.	Circuit	137144-001
4T		1/9259-020	H.	Transport Circuit, 7410.77	137123-001
5N-1, 6N-1		179257-028	ン	Integrated Cucuit, /4L2//	10000
	•				100 7676
	8Kx8, 70 nsec, part no. 137535-003		5K	Integrated Circuit, /4F/4	15/450-001
7C/D	Socket, 18 Pin. 300-Inch	179259-018	5L	Integrated Circuit, 74LS86	15/0/9-001
1 X 1	Socket, 20 Pin. 300-Inch	179259-020	5N-1	Integrated Circuit, RAM, 8Kx8,	
				85 nsec	137535-008
No To	Socket 2/ Dia 300-Inch	179259-024	6B	Integrated Circuit, 7805	137596-001
o), ow 1117 /	SOCKET, 24 FIII, .300-IIICII	170257.040	1		
IIIVL	SOCKEL, 40 Fill, SOOFILLI	170257.024	ų	Integrated Circuit, 74LS174	137122-001
12A- 1	Socket, 24 Pin, 600-inch	1/923/-024	ָ טַ	Integrated Circuit 741 S260	137332-001
12C	Socket, 20 Pin, .300-Inch	1/9259-020	0F	Integrated Circuit, 74HCT273	137655-001
		1	no V	integrated circuit, / Titol 2/3	1370/2-001
12D	Socket, 24 Pin, .300-Inch	179259-024	o O	Integrated Circuit, /4L202	100-710/01
13A	Socket, 24 Pin, .600-Inch	179257-024	,	11	100 0716
13C	Socket, 64 Pin, .900-Inch	179256-064	6K	Integrated Circuit, 74F104	15/508-001
13F	Socket, 24 Pin, .600-Inch	179257-024	T9	Integrated Circuit, 74LS245	137134-001
			6N-1	Integrated Circuit, RAM, 8Kx8,	1
13H 13H/	13H 13H/I 13I 13K 13K/L 13L			85 nsec	137535-008
1214, 1711, 1214, 1211	Socker 20 Din 600-Inch	179257-032	7B	Integrated Circuit, 74LS273	137040-001
10M, 10M	March March of American	75-00516	!		
(4A)	Null Washel Assy, #0-02	27/7-77	C/72	Integrated Circuit VM2413	137671-001
(2 A)	Screw, Pan Hd, X-Kec, #0-52 X 3/8L	/2-10005) }	Integrated Circuit 741 S107	137240-001
		;	٦ ا	integrated Chemit, 74527/	127222-001
1/2]	Integrated Circuit, 74LS157	137029-001	7E	Integrated Circuit, /4LS200	12/22-001
1D,	Integrated Circuit, EPROM	136082-1008	7F	Integrated Circuit, 74LS245	15/134-001
1F/H	Integrated Circuit, Lb	137536-001			
11	Integrated Circuit GAL16V8	136082-1000	7H	Integrated Circuit, 74HCT273	137655-001
r.	michaela ancam, cimico		71	Integrated Circuit, 74LS244	137038-001
	International Circuit TTDA 2020	137301-001	χ	Integrated Circuit, GAL16V8	136082-1002
2.A	Integrated Circuit, 1DAZO20	127570-001	NY MY		137612-001
2B	Integrated Circuit, 12004CIN	127580 001	, (4 ,		
ر ا	Integrated Circuit, 4000b	12/200-001	US J/BS	Integrated Circuit 741S32	137019-001
2D	Integrated Circuit, EPROM	120062-1007	8F 8F	Integrated Circuit, 741S245	137134-001
!		127000 001	8H, 05		•
2F		15/009-001	110	Micgialco Circuit, Ciam, 1101,	137546-002
2H	Integrated Circuit, 74LS15/	12/029-001	10	University 12011	136082-1003
2K/L	Integrated Circuit, MOB	15/595-001	6	incgrated enemi, others	
2N	Integrated Circuit, EPROM	156082-1009		CUCUI/E *:	127125 001
			8K	Integrated Circuit, /4L3233	136082-1004
3E/F	Circuit,	157456-001	SMI SMI	integrated Circuit, GALZOV8	127000 001
3F	Integrated Circuit, 74LS20	137060-001	9B/C	integrated Circuit, /41.504	13/003-001
3H	Integrated Circuit, 74F374	137420-001	9C/D	Integrated Circuit, 74LS/4	13/025-001
31	Integrated Circuit, 74F74	137436-001			
3			9D	Integrated Circuit, 74LS32	137019-001
3M	Integrated Circuit, 74F163	137345-001	9E, 9F	Integrated Circuit, 74F574	15/440-001
3N	Integrated Circuit, 74LS173	137529-001	Н6	Integrated Circuit, Dram, 4404,	1375/6 003
4C	Integrated Circuit, LM324	137582-001		04K x 4, 120N	700-046/61
	•				

Rampart 3-Player Game

Parts Illustratrations

Rampart Game PCB Assembly (3-Player Version) Parts List, Continued

C26-C29 Capacitor, .01 µF, 50 V, +80%-20%, Ceramic C26-C29 Capacitor, .1 µF, 50 V, +80%-20%, Ceramic C30-C33 Capacitor, .1 µF, 50 V, +80%-20%, Ceramic C34.C36-C39 Capacitor, .1 µF, 50 V, +80%-20%, Ceramic Capacitor, 1000 µF, 25 V, Electrolytic, Radial Capacitor, 1000 µF, 25 V, Electrolytic, Radial C41 Capacitor, .001 µF, 50 V, +80%-20%, Ceramic Capacitor, .002 µF, 50 V, +80%-20%, Ceramic Capacitor, .001 µF, 50 V, +80%-20%, Ceramic C35 Capacitor, .001 µF, 50 V, +80%-20%, Ceramic C55 Capacitor, .1 µF, 50 V, +80%-20%, Ceramic C55 Capacitor, .1 µF, 50 V, +80%-20%, Ceramic C56-C62 Capacitor, .1 µF, 50 V, Electrolytic, C64, C65, Capacitor, .1 µF, 50 V, Electrolytic C64, C65, Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Ceramic C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Capacitor, .001 µF, 50 V, +80%-20%, C67, C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Capacitor, .001 µF, 50 V, +80%-20%, C67, C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C69 Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C68 Capacitor, .1 µF, 50 V, +80%-20%, C67, C67, C67, C67, C67, C67, C67, C67	F F		C18-C25 C26-C29 C30-C33 C34,C36-C39 C40 C41 C42 C42 C48 C51	.01 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .01 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .1 μF, 50 V, Electrolytic, .1 μF, 50 V, +80%–20%, .0022 μF, 50 V, Ceramic .001 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .270 pF, 100 V, ±5%,	
Integrated Circuit, 74P04 137437-001 C26 C29 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E03 137437-001 C30-C33 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E3138 137430-001 C30-C33 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E323 137430-001 C30-C33 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E323 137430-001 C30-C33 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E323 137430-001 C42-C47 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E323 137430-001 C42-C47 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E323 137430-001 C42-C47 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E324 137430-001 C42-C47 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-001 C31 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-001 C31 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-001 C32 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-001 C32 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-001 C33 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C35 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C36 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E34 137430-1001 C36 Capacitor, 1 Ja; 50 V, 48096-2096, Integrated Circuit, 74E	tt. tt. tt.	_	C26-C29 C30-C33 C34,C36-C39 C40 C41 C41 C42-C47 C48 C49	1 μF, 50 V, +80%–20%, .01 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, 1000 μF, 25 V, Electrolytic, 47 μF, 25 V, Electrolytic, .1 μF, 50 V, +80%–20%, .0022 μF, 50 V, Ceramic .001 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .270 pF, 100 V, ±5%,	
Integrated Circuit, 74153 13772-001 C90-C33 Capacitor, 1.1p.; 50 v. +80%-20%, 18773-001 C90-C33 Capacitor, 1.1p.; 50 v. +80%-20%, 18771-001 C40-C35 Capacitor, 1.1p.; 50 v. +80%-20%, 18771-001 C40-C35 Capacitor, 1.1p.; 50 v. +80%-20%, 18772-001 C40-C37 Capacitor, 1.1p.; 50 v. +80%-20%, 18772-001 C51-C37 Capacitor, 1.1p.; 50 v. +80%-20%, 18772-001 C52-C32 Capacitor, 1.1p.; 50 v. +80%-20%, 18772-001 C53-C32 Capacitor, 1.1p.; 50 v. +80%-20%, 18772-001 C65-C32 Capacitor, 1.1p.; 50 v. +80%-20%, 18772-001 C67-C32 Capacitor, 1.1p.; 50 v. +80%-20%, Ca	r. tr	_	C30-C33 C34,C36-C39 C40 C41 C42-C47 C48 C49	1 μ, 50 γ, 700 20 20 γ, 10 μ, 50 V, +80%–20%, 1 μ, 50 V, +80%–20%, 1000 μ, 25 V, Electrolytic, 47 μ, 50 V, +80%–20%, 1002 μ, 50 V, +80%–20%, 1 μ, 50 V, +80%–20%, 270 p, 100 V, ±5%,	
Integrated Circuit, 741535 37175-001 C39.C33 Capacitor, .01 µF, 50 V, +80%-20% 18777-001 Caramic Circuit, 741535 13772-001 C40.C35 Capacitor, .1 µF, 50 V, +80%-20% 18772-001 C40.C35 Capacitor, .1 µF, 50 V, +80%-20% 18772-001 C40.C35 Capacitor, .1 µF, 50 V, +80%-20% 18772-001 C40.C47 Capacitor, .1 µF, 50 V, +80%-20% 18772-001 C50.C47 Capacitor, .1 µF, 50 V, +80%-20% 18772-001 C60.C47 Capacitor, .1 µF	(T.) [L.) [L.)	_	C30-C33 C34,C36-C39 C40 C41 C42-C47 C48 C49	.01 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, 1000 μF, 25 V, Electrolytic, 47 μF, 25 V, Electrolytic, .1 μF, 50 V, +80%–20%, .0022 μF, 50 V, Ceramic .001 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .270 pF, 100 V, ±5%,	• • • • • • • • • • • • • • • • • • • •
Integrated Circuit, 7415138 Integrated Circuit, 7415138 Integrated Circuit, 7415138 Integrated Circuit, 741523 Integrated Circuit, 741524	11 3 3 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1		C34,C36-C39 C40 C41 C42-C47 C48 C49	1 μF, 50 V, +80%–20%, 1000 μF, 25 V, Electrolytic, 47 μF, 25 V, Electrolytic, .1 μF, 50 V, +80%–20%, .0022 μF, 50 V, Ceramic .001 μF, 50 V, +80%–20%, .1 μF, 50 V, +80%–20%, .270 pF, 100 V, ±5%,	
Integrated Circuit, 741508 137012-001 C40 Capacitor, 100 µF, 25 V, Electrolytic, Integrated Circuit, 741534 13742-001 C40 Capacitor, 100 µF, 25 V, Electrolytic, Integrated Circuit, 741535 13742-001 C42-C47 Capacitor, 11 µF, 50 V, +80%-20%, Integrated Circuit, 741534 13742-001 C48 Capacitor, 101 µF, 50 V, +80%-20%, Integrated Circuit, 741534 13742-001 C49 Capacitor, 11 µF, 50 V, +80%-20%, Integrated Circuit, 741534 13742-001 C49 Capacitor, 101 µF, 50 V, +80%-20%, Integrated Circuit, 741534 13742-001 C51 Capacitor, 101 µF, 50 V, +80%-20%, Integrated Circuit, 741534 13742-001 C51 Capacitor, 270 µF, 100 V, ±5%, Integrated Circuit, 741534 13742-001 C51 Capacitor, 270 µF, 100 V, ±5%, Integrated Circuit, 741534 13742-001 C51 Capacitor, 270 µF, 100 V, ±5%, Integrated Circuit, 741534 13742-001 C51 Capacitor, 270 µF, 100 V, ±5%, Integrated Circuit, 741534 13742-001 C52 Capacitor, 270 µF, 100 V, ±5%, Integrated Circuit, 741534 13742-001 C53 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 741534 13742-001 C52 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 741534 13742-001 C54 C62 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C54 C65 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C54 C65 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C54 C65 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C64 C65 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C64 C65 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C64 C65 Capacitor, 11 µF, 50 V, ±10%, Integrated Circuit, 141534 13742-001 C64 C65 Capacitor, 11 µF, 50 V, ±10%, 20%, 140%-20%, Integrated Circuit, 141534 13742-100 C63 Capacitor, 11 µF, 50 V, ±10%-20%, Integrated Circuit, 141534 13742-100 C63 Capacitor, 11 µF, 50 V, ±10%-20%, Integrated Circuit, 141634 13742-100 C72 Capacitor, 11 µF, 50 V, ±10%-20%, Integrated Circuit, 141634 13742-100 C72 Capacitor, 11	2F 2F	_	C40 C41 C42-C47 C48 C49 C51	Capacitor, 1 pt., 7°, 7°, 7°, 7°, 7°, 7°, 7°, 7°, 7°, 7°	
Integrated Circuit, 741525 1375420-001 C40 Capacitor, 1000 µF, 25 V, Electrolytic, Integrated Circuit, 741525 137545-002 C41 Capacitor, 1000 µF, 25 V, Electrolytic, Integrated Circuit, 741525 137545-001 C42-C47 Capacitor, 1, 145 50 V, +8094-2096, Integrated Circuit, 741535 13745-001 C42-C47 Capacitor, 1, 145 50 V, +8094-2096, Integrated Circuit, 74153161 A 137045-001 C43 Capacitor, 0.002 µF, 50 V, +8094-2096, Integrated Circuit, 74153161 A 137045-001 C43 Capacitor, 0.01 µF, 50 V, +8094-2096, Integrated Circuit, 7415314 13745-001 C53 Capacitor, 0.01 µF, 50 V, +8094-2096, Integrated Circuit, 741534 13735-001 C53 Capacitor, 0.01 µF, 50 V, +8094-2096, Integrated Circuit, 741534 13735-001 C53 Capacitor, 0.01 µF, 50 V, +8094-2096, Integrated Circuit, 741534 13735-001 C53 Capacitor, 0.01 µF, 50 V, +8096-2096, Integrated Circuit, 741534 13735-001 C53 Capacitor, 0.03 µF, 50 V, ±1096, 13735-001 C53 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 13705-002 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 13705-003 C55 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 13705-003 C55 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 13705-003 C55 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 13705-003 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 13705-003 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, Integrated Circuit, CALION 136082-1030 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, 13705-003 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, 13705-003 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, 13705-003 C54 Capacitor, 0.01 µF, 50 V, ±8096-2096, 122002-103 C73 Capacitor, 0.01 µF, 50 V, ±80	2F 2F	_	C40 C41 C42-C47 C48 C49 C51	Capacitor, 1000 μF, 25 V, Electrolytic, Radial Capacitor, 47 μF, 25 V, Electrolytic, Radial Capacitor, .1 μF, 50 V, +80%–20%, Ceramic Capacitor, .0022 μF, 50 V, Ceramic Capacitor, .001 μF, 50 V, +80%–20%, Ceramic Capacitor, .1 μF, 50 V, +80%–20%, Ceramic Capacitor, .1 μF, 50 V, +80%–20%, Ceramic Capacitor, .1 μF, 50 V, +80%–20%, Ceramic	
Radial	7		C41 C42-C47 C48 C49 C51	47, µF, 2 .1 µF, 50 .0022 µF, .001 µF, 50 270 pF,	123015-476 122002-104 122002-102 122002-102 122002-104 122002-104
Galesti 120N 13754-002	11 E	_	C42-C47 C48 C49 C51	4, µr, 2, 11 µF, 50, 20022 µF, 2001 µF, 50, 270 pF, 27	123015-476 122002-104 122015-222 122002-102 122002-104 122016-271
Integrated Circuit, 741535 137492-001 C48 Capacitor, 1.0 Jr. 50 V, +80%-20%, Integrated Circuit, 741515 137492-001 C48 Capacitor, 0.022 Jr. 50 V, +80%-20%, Integrated Circuit, 741515 137492-001 C48 Capacitor, 0.022 Jr. 50 V, +80%-20%, Integrated Circuit, 741515 137492-001 C49 Capacitor, 0.01 Jr. 50 V, +80%-20%, Integrated Circuit, 7415253 137135-001 C57 Capacitor, 700 Jr. 10 V, ±5%, Integrated Circuit, 7415245 137354-001 C53 Capacitor, 700 Jr. 10 V, ±5%, Integrated Circuit, 7415245 137354-001 C53 Capacitor, 700 Jr. 10 V, ±5%, Integrated Circuit, 7415245 13734001 C53 Capacitor, 700 Jr. 10 V, ±5%, Integrated Circuit, 7415245 13734001 C53 Capacitor, 700 Jr. 10 V, ±5%, Integrated Circuit, 741534 1374001 C55 Capacitor, 1.0 V, ±6%-20%, Integrated Circuit, 741534 1374001 C55 Capacitor, 1.0 V, ±6%-20%, Integrated Circuit, 741534 1374001 C55 Capacitor, 1.0 V, ±6%-20%, Integrated Circuit, 20 nsee 137694-2002 C64 C65 Capacitor, 1.0 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 1.0 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Integrated Circuit, EPROM 136082-1030 C64 C65 Capacitor, 0.0 Jr. 50 V, ±6%-20%, Caramic Capacitor, 1.0 Pr. 10 V, ±5%, Capacitor, 1.0 Pr. 10 V, ±5%, Capacitor, 1.0 Pr. 50 V, ±6%-20%, Caramic Capacitor, 0.0 Jr. 50 V, ±6%-2	7		C42-C47 C48 C49 C51	.1 µF, 5C .0022 µF .001 µF, .1 µF, 5C 270 pF,	122002-104 122015-222 122002-102 122002-104 122016-271
Integrated Circuit, 74F153 137492-001 C48 Capacitor, 0.002 µF, 50 V, Ceramic Integrated Circuit, 74E15161 A 137492-001 C48 Capacitor, 0.002 µF, 50 V, Ceramic Integrated Circuit, 74E3161 A 137492-001 C49 Capacitor, 0.01 µF, 50 V, 480%-20% Integrated Circuit, 74E374 13742-001 C51 Capacitor, 1.0 µF, 50 V, 480%-20% Integrated Circuit, 74E375 13742-001 C52 Capacitor, 1.0 µF, 50 V, 410%, 13734-001 C67	1F		C48 C49	rr, .0022 µF rr, .001 µF, rr, .1 µF, 5C rr, 270 pF,	122002-104 122015-222 122002-102 122002-10 4 122016-271
Integrated Circuit, 7415134 137177-001 C49 Capacitor, 101 µF, 50 V, 480%-20% 137177-001 Integrated Circuit, 7415134 13745-001 C51 Capacitor, 270 µF, 100 V, ±59% 137177-001 C45 Capacitor, 270 µF, 100 V, ±59% 137177-001 C52 Capacitor, 270 µF, 100 V, ±59% 137177-001 C53 Capacitor, 270 µF, 100 V, ±59% 13754-001 C53 Capacitor, 270 µF, 100 V, ±59% 13754-001 C54 Capacitor, 270 µF, 100 V, ±59% 13754-001 C54 Capacitor, 270 µF, 100 V, ±59% 13754-001 C54 Capacitor, 33 µF, 50 V, ±10%, 13754-001 C54 Capacitor, 11 µF, 50 V, ±10%, 137304-2002 C54 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C56-C62 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C56-C62 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C67 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C67 C36 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C67 C36 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C67 C36 Capacitor, 11 µF, 50 V, ±10%, 13752-001 C67 C36 Capacitor, 11 µF, 50 V, ±10%, 136082-1030 C64 C65 Capacitor, 10 µF, 50 V, ±10%, 136082-1030 C41000	11 E		C51	.001 µF, 50 .1 µF, 50 270 pF,	122002-102 122002-104 122016-271
Integrated Circuit, 741574 13745-001 C49 Capacitor, 001 Jr. 50 V, +80%-20%, 101620ated Circuit, Dram, 4464, 13745-001 C51 Capacitor, 1 Jr. 50 V, +80%-20%, 13754-001 C52 Capacitor, 270 pr. 100 V, ±5%, 13754-001 C53 Capacitor, 270 pr. 100 V, ±5%, 13754-001 C53 Capacitor, 270 pr. 100 V, ±5%, 13754-001 C53 Capacitor, 270 pr. 100 V, ±5%, 13754-001 C54 Capacitor, 270 pr. 100 V, ±5%, 13754-001 C53 Capacitor, 270 pr. 100 V, ±5%, 13754-001 C54 Capacitor, 270 pr. 100 V, ±80%-20%, 13754-001 C54 Capacitor, 270 pr. 100 V, ±80%-20%, 13754-200 C54 Capacitor, 270 pr. 100 Pr. 200 V, ±80%-20%, 13754-200 C64 C65 Capacitor, 270 pr. 100 Pr. 200 V, ±80%-20%, 13754-200 C64 C65 Capacitor, 270 pr. 100 Pr. 200 V, ±80%-20%, 13754-200 C67 C68 Capacitor, 270 pr. 100 Pr. 200 V, ±80%-20%, 13754-200 C67 C68 Capacitor, 270 pr. 100 Pr. 200 V, ±80%-20%, 122015-103 C70 Capacitor, 270 pr. 100 Pr. 100 V, ±5%, 122017-224 C71 Capacitor, 270 pr. 100 Pr. 100 V, ±5%, 122017-224 C71 Capacitor, 270 pr. 100 Pr. 100 V, ±5%, 122017-224 C67	11. ZF		C49	.001 µF, 50 .1 µF, 50 270 pF,	122002-102 122002-10 4 122016-271
Integrated Circuit, Dram, 4464, 137420-001 C51 Capacitor, 1 µF, 50 V, +80%-20%, 148240	11		C51	ř, ř,	122002-10 4 122016-271
Integrated Circuit, 74L223 137546-001 C53 Capacitor, 270 pF, 100 V, ±5%, 100 megrated Circuit, 30S 137550-001 C53 Capacitor, 0.33 µF, 50 V, ±10%, 137364-2001 C53 Capacitor, 0.33 µF, 50 V, ±10%, 137364-2002 Caramic Circuit, CALIÓWS 137364-2002 C54 Capacitor, 1 µF, 50 V, ±10%, 137364-2002 C55 Capacitor, 1 µF, 50 V, ±10%, 137364-2002 C54 Capacitor, 1 µF, 50 V, ±10%, 137364-2002 C55 Capacitor, 1 µF, 50 V, ±10%, 137364-2002 C54 Capacitor, 1 µF, 50 V, ±10%, 137364-2002 C64 C65 Capacitor, 1 µF, 50 V, ±10%, 137364-2002 C64 C65 Capacitor, 1 µF, 50 V, ±10%, 137369-103 C64 C65 Capacitor, 1 µF, 50 V, ±10%, 137369-103 C64 C65 Capacitor, 1 µF, 50 V, ±10%, 20%, 140%,	2 E		i i		122016-271
Integrated Circuit, 7415253 17135-001 C53 Capacitor, 0.93 µF, 50 V, ±100V, 17755-001 C53 Capacitor, 0.93 µF, 50 V, ±100V, 17755-001 C53 Capacitor, 0.93 µF, 50 V, ±100V, 177504-2002 C54 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2002 C54 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2002 C54 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 177504-2003 C64 C65 Capacitor, 1 µF, 50 V, Electrolytic, 17608-2103 C70 Capacitor, 0.01 µF, 50 V, Electrolytic, 17608-2103 C70 Capacitor, 0.01 µF, 50 V, Electrolytic, 124000-226 C71 Capacitor, 0.01 µF, 50 V, Electrolytic, 124000-226 C71 Capacitor, 0.01 µF, 50 V, Electrolytic, 122017-224 C6ramic, Capacitor, 0.01 µF, 50 V, Electrolytic, 122017-224 C6ramic, C6r	74 75 C				122016-271
Integrated Circuit, 20S Integrated Circuit, 7415245 Integrated Circuit, 7415245 Integrated Circuit, 7415245 Integrated Circuit, 7415245 Integrated Circuit, 7415246 Integrated Circuit, 7415246 Integrated Circuit, 7415246 Integrated Circuit, 741524 Integrated Circuit, Mrom, 4 Meg Integrated Circuit, Mrom,	2F	137550-001 137134-001 137304-2002	1		
Integrated Circuit, 7415245 Integrated Circuit, GAL16V8 Integrated Circuit, GAL16V8 Integrated Circuit, GAL16V8 Integrated Circuit, GAL16V8 Integrated Circuit, AFP374 Integrated Circuit, AFP38 Integrated Circuit, AFP38 Integrated Circuit, BROW Integrated Circuit, BROW Integrated Circuit, BROW Integrated Circuit, AFP38 Integrated Circuit, BROW Integrated Circu	2F	137134-001	C53		122015-333
Integrated Circuit, Leta 137304-2002 G54 Capacitor, 47 µF, 25 V, Electrolytic, Integrated Circuit, Leta 137412-118 G56-G2 Capacitor, 1 µF, 50 V, Electrolytic 13742-001 G56-G2 Capacitor, 1 µF, 50 V, Electrolytic 137304-2002 G55 Capacitor, 1 µF, 50 V, Electrolytic 137304-2002 G53 Capacitor, 1 µF, 50 V, Electrolytic 137304-2002 G53 Capacitor, 1 µF, 50 V, Electrolytic 137304-2002 G63 Capacitor, 1 µF, 50 V, Electrolytic 137321-001 G67, C68 Capacitor, 1 µF, 50 V, Electrolytic 137521-001 G67, C68 Capacitor, 1 µF, 50 V, Electrolytic 137632-1032 G69 Capacitor, 1 µF, 50 V, H80%-20%, Integrated Circuit, Mrom, 4 Meg 136082-1032 G69 Capacitor, 001 µF, 50 V, H80%-20%, Integrated Circuit, Mrom, 4 Meg 136082-1033 G70 Capacitor, 001 µF, 50 V, H80%-20%, Integrated Circuit, Mrom, 4 Meg 136082-1033 G70 Capacitor, 01 µF, 50 V, H80%-20%, Ceramic Capacitor, 22 µF, 55 V, Electrolytic 124000-226 G71 Gapacitor, 01 µF, 50 V, H80%-20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Gapacitor, 100 pF, 100 V	7. , 4. 9. 6. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9. 9.	137304-2002		Ceramic	144017-000
Integrated Circuit, GAL16V8 Integrated Circuit, SLAPSTIC Integrated Circuit, AF374 Integrated Circuit, AF374 Integrated Circuit, Leta Integrated Circuit, Leta Integrated Circuit, Leta Integrated Circuit, AF138 Integrated Circuit, EPROM Integrated Circu	2F 4 9	/ 000	C54		
Integrated Circuit, 74F374 137420-001 C55- Capacitor, 1 JH, 50 V, 180%-20%, 1 Integrated Circuit, 74F374 137304-2002 C65 Capacitor, 1 JH, 50 V, 180%-20%, 1 Integrated Circuit, 1 JH, 50 V, 180%-20%, 1 Integrated Circuit, 24F374 137521-001 C65, C68 Capacitor, 1 JH, 50 V, 180%-20%, 1 Integrated Circuit, 24F08 137521-001 C67, C68 Ceramic Integrated Circuit, 1 JH, 25 V, 2 JH, 25 V, 3 JH,	7.	136082-1006	į		123015-476
Fintegrated Circuit, 74F374 137420-001 Coramic Integrated Circuit, 14F374 137420-001 Coramic Integrated Circuit, 68000, 8MHz, Plas 137304-2002 C64, C65, Capacitor, 1 µF, 50 V, H80%–20%, Integrated Circuit, 200 nsec 137648-200 C66, C66 Capacitor, 1 µF, 50 V, H80%–20%, Integrated Circuit, EPROM 136082-1032 C66 Capacitor, 001 µF, 50 V, H80%–20%, Integrated Circuit, Mrom, 4 Meg 136082-1032 C69 Capacitor, 001 µF, 50 V, H80%–20%, Integrated Circuit, Mrom, 4 Meg 136082-1033 C70 Capacitor, 010 µF, 50 V, H80%–20%, Ceramic Capacitor, 22 µF, 35 V, Electrolytic 124000-226 C71 Capacitor, 001 µF, 50 V, H80%–20%, Ceramic Capacitor, 1 µF, 50 V, H80%–20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 001 µF, 50 V, H80%–20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Cap	щ	137412-118	C55 C56-C62	1 pF,	124001-105
Integrated Circuit, Leta Integrated Circuit, Leta Integrated Circuit, 1200 nsec Integrated Circuit, 200 nsec Integrated Circuit, EPROM I				Î.	122002-104
Integrated Circuit, 74F138 Integrated Circuit, 74F138 Integrated Circuit, 74F138 Integrated Circuit, 200 nsec I37648-200 Integrated Circuit, 200 nsec I37648-200 C66 Capacitor, 101 µF, 50 V, +80%-20%, 136082-1033 Integrated Circuit, Mrom, 4 Meg I36082-1033 Capacitor, 22 µF, 55 V, Electrolytic, Capacitor, 22 µF, 55 V, Electrolytic, Capacitor, 1 µF, 50 V, +80%-20%, Ceramic Capacitor, 1 µF, 50 V, Ceramic Capacitor, 100 pF, 100 V, ±5%, Caramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 1 µF, 50 V, +80%-20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor			C63	Capacitor, 1 µF, 50 V, Electrolytic	124001-105
Integrated Circuit, 200 nsec 137648-200 Integrated Circuit, 200 nsec 137648-200 Integrated Circuit, EPROM Integrated Circuit, EPROM Integrated Circuit, EPROM Integrated Circuit, Mrom, 4 Meg 136082-1032 Integrated Circuit, Mrom, 4 Meg 136082-1033 Integrated Circuit, Mrom, 4 Meg 136082-1032 Integrated Circuit, Mrom, 4 Meg 136082-1032 Integrated Circuit, Mrom, 4 Meg 136082-1033 Integrated Circuit, Mrom, 4 Meg Integrated Circuit, Mrom, 4 Meg Integrated Circuit, Mrom, 4 Meg Integrated Circuit, Inte			C64, C65,		
Integrated Circuit, 200 nsec 137648-200 C66 Capacitor, .001 µF, 50 V, +80%-20%, Integrated Circuit, EPROM 136082-1032 C69 Capacitor, .0068 µF, 50 V, Ceramic Capacitor, .22 µF, 55 V, Electrolytic, Capacitor, .1 µF, 50 V, +80%-20%, Ceramic Capacitor, .100 pF, 100 V, ±5%, Ceramic Capacitor, .001 µF, 50 V, +80%-20%, Ceramic Capacitor, .100 pF, 100 V, ±5%, Ceramic Capa			C67, C68		
Integrated Circuit, EPROM Integrated Circuit, EPROM Integrated Circuit, EPROM Integrated Circuit, Mrom, 4 Meg I36082-1033 Integrated Circuit, Integrat		137648-200	99)		
Integrated Circuit, FIROM 136082-1031 C70 Capacitor, 10 µF, 50 V, +80%-20%, Ceramic Capacitor, 22 µF, 55 V, Electrolytic, 123015-476 C72 Capacitor, 10 µF, 50 V, +80%-20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Cer			690		122015-682
Integrated Circuit, Mrom, 4 Meg 136082-1033 C70 Capacitor, 0.1 µF, 50 V, +80%-20%, Caramic Capacitor, 1 µF, 55 V, Electrolytic, Radial Capacitor, 1 µF, 50 V, +80%-20%, 122002-104 C73-C80 Capacitor, 1 µF, 50 V, +80%-20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, 122016-101 Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 100 pF, 100 V, ±5%, 122016-101 Capacitor, 1 µF, 50 V, +80%-20%, Ceramic Capacitor, 1 µF,		7	3	capaciti, coco pri you;	
Capacitor, 22 µF, 35 V, Electrolytic Capacitor, 22 µF, 35 V, Electrolytic Capacitor, 47 µF, 25 V, Electrolytic Capacitor, 47 µF, 25 V, Electrolytic Capacitor, 47 µF, 25 V, Electrolytic Capacitor, 11 µF, 50 V, +80%-20%, 20%, 20% Capacitor, 12 µF, 50 V, +80%-20%, 2200-104 Capacitor, 100 µF, 100 V, ±5%, 22015-214 Capacitor, 100 µF, 100 V, ±5%, 22015-101 Capacitor, 100 µF, 100 V, ±5%, 22015-101 Capacitor, 100 µF, 100 V, ±5%, 22015-101 Capacitor, 11 µF, 50 V, +80%-20%, 22015-204 Capacitor, 11 µF, 50 V, +80		_	C/0	Capacitor, .01 µF, 50 V, +80%–20%,	122002-103
Capacitor, 47 µF, 25 V, Electrolytic, Radial Capacitor, 11 µF, 50 V, +80%–20%, 123015–476 C72 Capacitor, .001 µF, 50 V, +80%–20%, 122002-104 C73-C80 Capacitor, .1 µF, 50 V, +80%–20%, Ceramic Capacitor, .001 µF, 50 V, +80%–20%, Ceramic Capacitor, .001 µF, 50 V, +80%–20%, Ceramic Capacitor, .001 µF, 50 V, +80%–20%, Ceramic Capacitor, .000 pF, 100 V, ±5%, Ceramic Capacitor, .1 µF, 50 V, +80%–20%, Ceramic Cap		<u>.</u>	C71	Ľ,	
Radial Capacitor, 1 µF, 50 V, +80%–20%, Ceramic Capacitor, 22 µF, 50 V, Ceramic Capacitor, 100 pF, 100 V, ±5%, Capacitor, 100 pF, 100 V, ±5%, Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 1 µF, 50 V, +80%–20%, Ceramic Capacitor, 1 µF, 50 V, +80			5	£	
Capacitor, 1 µt, 50 V, +80%-20%, Ceramic Capacitor, 10 pF, 100 V, ±5%, Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 1 µF, 50 V, +80%-20%, Capacitor, 1 µF, 50 V, +80%-20			C72	Capacitor, .001 μF, 50 V, +80%–20%,	
Capacitor, .22 μF, 50 V, Ceramic 122017-224 Capacitor, 100 pF, 100 V, ±5%, 122016-101 Ceramic Capacitor, .001 μF, 50 V, +80%–20%, Ceramic Capacitor, .001 μF, 50 V, +80%–20%, Ceramic Capacitor, .100 pF, 100 V, ±5%, Ceramic Capacitor, .1 μF, 50 V, +80%–20%, 122016-101 Ceramic Capacitor, .1 μF, 50 V, +80%–20%, 122016-101 Ceramic Capacitor, .1 μF, 50 V, +80%–20%, 122016-101 Ceramic Capacitor, .1 μF, 50 V, +80%–20%, 122016-104 Ceramic Capacitor, .1 μF, 50 V, +80%–20%, 122016-104			(73-680	r. 1 L.F.	122002-102
Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, .001 µF, 50 V, +80%–20%, Capacitor, .001 µF, 50 V, +80%–20%, Capacitor, .001 µF, 50 V, +80%–20%, Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, .1 µF, 50 V, +80%–20%, Capacitor, .1 µF, 50 V, +80%–20%, Capacitor, .1 µF, 50 V, +80%–20%, Ceramic Capacitor, .1 µF, 50 V, +80%–20%, Capacitor, .1 µF, 50 V,				Î.	122002-104
Ceramic Capacitor, 001 µF, 50 V, +80%–20%, Ceramic Capacitor, 100 pF, 100 V, ±5%, Ceramic Capacitor, 1 µF, 50 V, +80%–20%, Ceramic		%,	C81, C82	.001 µF,	_
Capacitor, .001 µF, 50 V, +80%–20%, Ceramic C83-C141 Capacitor, .1 µF, 50 V, +80%–20%, 122002-102 Capacitor, 100 pF, 100 V, ±5%, 122016-101 Ceramic Ceramic Capacitor, .1 µF, 50 V, +80%–20%, 122016-104 Capacitor, .1 µF, 50 V, +80%–20%, 122016-104 Ceramic Ceramic Capacitor, .1 µF, 50 V, +80%–20%, 122016-104		122016-101		1	122002-102
Capacitor, 100 pF, 100 V, ±5%, Capacitor, 100 pF, 100 V, ±5%, Capacitor, 100 pF, 100 V, ±5%, Ceramic		%-20%, Ceramic	C83-C141	.1 µF, 50 V,	122002-104
Ceramic 122016-101 Ceramic 122016.10 Ceramic 143-C147 Capacitor, .1 µF, 50 V, +80%-20%, 122002-104 Ceramic Ceramic		,%,	C142	Ĕ,	
Capacitor, .1 µF, 50 V, +80%0-20%, 122002-104 C143-C147 Capacitor, .1 µL, 50 V, 1007-2070, Ceramic		122016-101	-717 6717		122010-101
		-20%, 122002-104	C143-C14/		122002-104

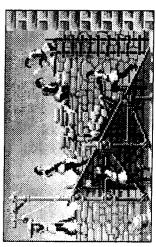
Rampart Game PCB Assembly (3-Player Version) Parts List, Continued

nator	Description	Part No.	Desig- nator	Description	Part No.
C148 C149-C15 C159-C16	C148 Capacitor, 100 pF, 100 V, ±5%, Ceramic C149-C157, Capacitor, .1 μF, 50 V, +80%–20%, C159-C167 Ceramic	122016-101	R73 R74 R75, R76 R77	Resistor, 7.5 K Ω , ±5%, 1/8 W Resistor, 15 K Ω , ±5%, 1/8 W Resistor, 30 K Ω , ±5%, 1/8 W Resistor, 15 K Ω , ±5%, 1/8 W	110027-752 110027-153 110027-303 110027-153
CR1-CR3 CR4, CR5 CR6, CR7 CR8	Diode, 1N4001 Diode, MV5053, Light Emitting Diode, 1N4001 Diode, MV5053, Light Emitting	131048-001 131027-002 131048-001 131027-002	R78 R79 R80 R81	Resistor, 7.5 K Ω , ±5%, 1/8 W Resistor, 20 K Ω , ±5%, 1/8 W Resistor, 15 K Ω , ±5%, 1/8 W Resistor, 30 K Ω , ±5%, 1/8 W	110027-752 110027-203 110027-153 110027-303
GND1,GND HS1	GND1,GND2 Test Point HS1 Heat Sink, TDA2030	179051-001 178190-016	R82 R83 R84, R85 R86	Resistor, 20 K Ω, ±5%, 1/8 W Resistor, 2.2 K Ω, ±5%, 1/8 W Resistor, 4.7 K Ω, ±5%, 1/8 W Resistor, 2.2 K Ω, ±5%, 1/8 W	110027-203 110027-222 110027-472 110027-222
JMP1, JMP: L1 Q1-Q3	JMP1, JMP2 Connector, 2 Ckt, Header, .100 Ctr L1 Inductor, 100 µH Q1-Q3 Transistor, 2N5306	179048-002 141024-001 133033-001	R87, R88 R90 R91 R92	Resistor, 1 K Ω , $\pm 5\%$, 1/8 W Resistor, 10 Ω , $\pm 5\%$, 1/8 W Resistor, 220, $\pm 5\%$, 1/8 W Resistor, 100 K Ω , $\pm 5\%$, 1/8 W	110027-102 110027-100 110027-221 110027-104
R R R R R R R R R R R R R R R R R R R	Resistor, 1.5 K Ω, ±5%, 1/8 W Resistor, 1 K Ω, ±5%, 1/8 W Resistor, 30 K Ω, ±5%, 1/8 W Resistor, 220, +5%, 1/8 W	135041-001 110027-152 110027-102 110027-303	R93-R95 R96 R97 R98	Resistor, 470 Ω, ±5%, 1/8 W Resistor, 100 Ω, ±5%, 1/8 W Resistor, 10 Ω, ±5%, 1/8 W Resistor, 100 Ω, ±5%, 1/8 W	110027-471 110027-101 110027-100 110027-101
R5 R6 R7	Resistor, 1.5 K \(\Omega\), 1/8 W Resistor, 470 \(\Omega\), 1/8 W Resistor, 1 K \(\Omega\), 1/8 W Resistor, 20 K \(\Omega\), 1/8 W	110027-152 110027-471 110027-102 110027-102	R99 R100 R101 R102-R104	Resistor, 10 Ω , $\pm 5\%$, 1/8 W Resistor, 100 Ω , $\pm 5\%$, 1/8 W Resistor, 10 Ω , $\pm 5\%$, 1/8 W Resistor, 15, $\pm 5\%$, 1/8 W	110027-100 110027-101 110027-100 110027-150
R9 R10, R11 R12-R29 R30-R33	Resistor, 0 Q, ±5%, 1/4 W Resistor, 1 K Q, ±5%, 1/8 W Resistor, 470 Q, ±5%, 1/8 W Resistor, 10 K Q, ±5%, 1/8 W	110005-001 110027-102 110027-471 110027-103	R105 R106 R107 R108, R109	R105 Resistor, 2.4 K Ω, ±5%, 1/8 W R106 Resistor, 1 K Ω, ±5%, 1/8 W R107 Resistor, 2.4 K Ω, ±5%, 1/8 W R108, R109 Resistor, 1 K Ω, ±5%, 1/8 W	110027-242 110027-102 110027-242 110027-102
R34-R39 R40-R45 R47 R48, R49	Resistor, 1 K Q, ±5%, 1/8 W Resistor, 10 K Q, ±5%, 1/8 W Resistor, 10 Q, ±5%, 1/8 W Resistor, 10 Q, ±5%, 1/8 W Resistor, 10 K Q, ±5%, 1/8 W	110027-103 110027-103 110027-100 110027-103	R110 R112, R113 R114 R115	R110 Resistor, 2.4 K Q, ±5%, 1/8 W R112, R113 Resistor, 10 Q, ±5%, 1/8 W R114 Resistor, 4.7 K Q, ±5%, 1/8 W R115 Resistor, 100 Q, ±5%, 1/8 W	110027-242 110027-100 110027-472 110027-101
R50-R55 R56, R57 R58 R58 R59	,	110027-102 110027-102 110027-153 110027-153	R116, R117 R118 R119 R121-R128	R116, R117 Resistor, 10 K Ω, ±5%, 1/8 W R118 Resistor, 100 Ω, ±5%, 1/8 W R119 Resistor, 10 Ω, ±5%, 1/8 W R121-R128 Resistor, 1 K Ω, ±5%, 1/8 W	110027-103 110027-101 110027-100 110027-102
R60, R61 R62 R63 R64		110027-203 110027-512 110027-153 110027-203	R130 RP1-RP3 SW2	Resistor, 10 Ω , $\pm 5\%$, 1/8 W Res, R2R Switch, Slide, SPDT Thermal Companied	118016-001 118016-001 160040-001
R65 R66-R68 R69 R70-R72	Potentiometer, 10 K Ω , Vert, w/Knob 119020-103 Resistor, 10 Ω . $\pm 5\%$, 1/8 W 110027-100 Resistor, 10 K Ω . $\pm 5\%$, 1/8 W 110027-103 Resistor, 470 Ω . $\pm 5\%$, 1/8 W 110027-471	119020-103 110027-100 110027-103 110027-471	i G	Integrated Circuit, MSM6295 Surface-Mount	137607-001

CHAPTER 5

Schematic Diagrams

This chapter contains the schematics diagrams for your RampartTM game PCB. The game wiring diagram is also included



in this chapter. The Rampart 3-player game PCB assembly drawing is illustrated in Chapter 4 of this

manual.

Schematic Diagrams

Rampart

GND C32 C31 C3 C3 C3 C32 C31 C3 CND 01 01 01

JRH-CC RYTBOR JRH-DD RYTBOK JRH-25 RYTBOR JRH-26 RYTBOK

\$R18 \$R20 \$R22 \$R24 \$R19 \$R21 \$R23 \$R25

55V R46 10 10 6ND W

7.ETA

\$R13 \$R17 \$R16 \$R26 \$R27

JAM-15) SELFIEST FIRER-----

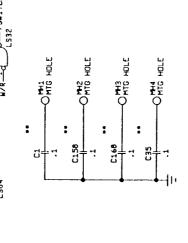
ROTR-JAM-U ROTE JAM-17 FIREC JAM-22 FIREC

+ 016 + C27 + C22 + C24 + C19 + C21 + C23 + C2 + .01 + .01 + .01 + .01 + .01 + .01 + .01

JOH-18 LYTEGA JOH-29 LYTEGA JOH-27 LYTEGA JOH-27 CYTEGA JOH-2 CYTEGA JOH-2 CYTEGA JOH-2 CYTEGA JOH-2 CYTEGA

SELF-TEST

FIDUCIAL MARKS FOR SURFACE MOUNT,



\$R15 \$R28 \$R14 \$R29 \$R12 \$R70 \$R71 \$R72 470 \$470 \$470 \$470 \$470

+ 1 + 1 + 1 + 1 + 1 + 1 + 1

Figure 5-1 RampartTM Game PCB Assembly Schematic Diagram OMSSGR-01 D

.. NOT STUFFED.

\$866 \$867 \$R

C15 + C28 + C14 + C29 + C12

JRH-16, COINL JRH-23, COINR JRH-T7, COINR JRH-RA, TIRER JRH-RA, SERVICE



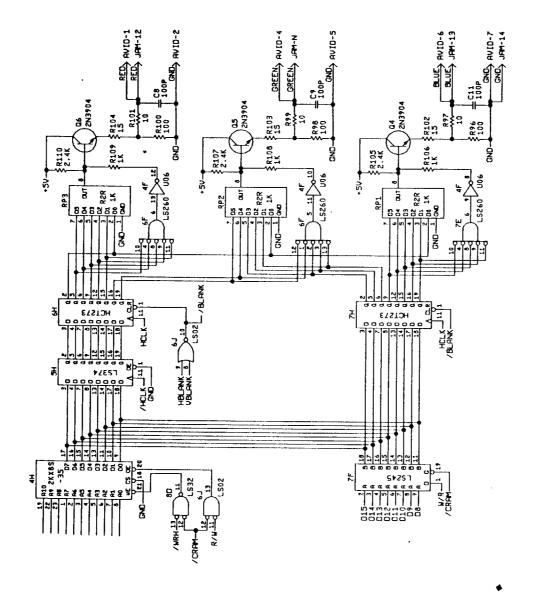


Rampart

Schematic Diagrams







\$895 470 VSTNCOUT AVID-10

\$R94 \$470

HSYNCOUT > AVIO-11

100, C30 C31 C31 C31 C31

/COMPSTN AVID-9

8-01VA ←OND

Figure 5-1 RampartTM Game PCB Assembly Schematic Diagram 048806-01 D

5-6

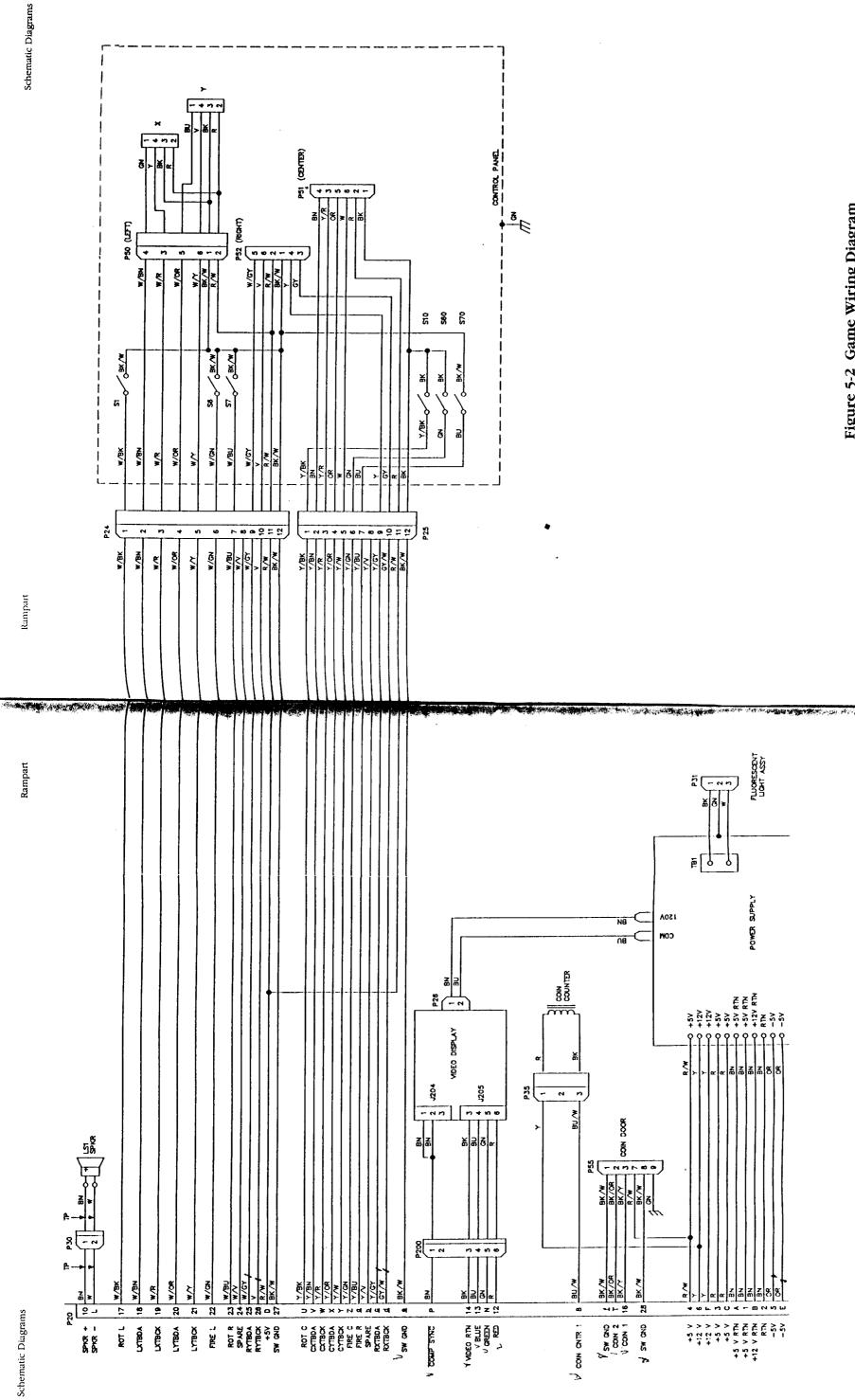


Figure 5-2 Game Wiring Diagram 048473-01 A

Bad ROM Locations by Error Address

cation		/]		: ا	ĸij.		.* uc)				
ROM Location Low	ation*:	13H/J	13H/J	13K	13L	13N	figuration*	13H/J	13K	13K	13K	131
Error Address	24 Configur	0K-1	20K-L	40K-L	80K-L	COK-L	2x4096 Con	OK-L	20K-L	40K-L	80K-L	COK-I
ROM Location High	Program ROM 8x1024 Configuration*:	13H	13H	131	13K/L	13M	Program ROM 2x512 and 2x4096 Configu	13H	133	133	133	131
Error Address	£	0K-H	20K-H	40K-H	80K-H	COK-H	Program	0K-H	20K-H	40K-H	80K-H	COK-H

If you bave 8x32-pin ceramic parts in column 13 on your Rampart Game PCB, you bave an 8x1024 configuration. If you bave 2x28-pin ceramic parts and 2x32-pin plastic parts in column 13 of this board, you bave a 2x512 and 2x4096 configuration.

by Error Address **Bad RAM Locations**

Type of RAM	Address	RAM Location Data Bits	Data Bits
Playfield RAM	200000-21FFFF	11H	0-3
		10H	4-7
		H6	8-11
		8H	12-15
Motion Object RAM 3E0000-3E3FFF	3E0000-3E3FFF	N9	0-7
		N.C	8-15
Color RAM	3C0000-3C07FF	4H	8–15

Figure 5-3 Faulty RAM/ROM Tables

NDIX APPE

Charles and Consultance Consultance

Rampart

TIOSSAIT

through zero again to a maximum negative Alternating current, from zero it rises to a maximum positive level, then passes

ACTIVE STATE

The true state of a signal. For example: The active state for is low.

ADDRESS

data in memory: normally expressed in hex-A value that identifies a specific location of adecimal notation.

ANALOG

Measurable in an absolute quantity (as opposed to on or off). Analog devices are volume controls, light dingmers, stereo amplifiers, etc.

Able to send or receive data on the same line (e.g., the data bus of a microprocessor). A number system that expresses all values by using two digits (0 and 1). the video display screen. BIDIRECTIONAL BINARY

A 6-digit electromechanical device that counts the coins inserted in the coin mecha-

Occurring at the same time.

panel, or the formed device used to frame

A cut, formed, or machined retention device, such as the conical device used to mount a pushbutton switch to a control

COIN COUNTER

A device on the inside of the coin door that inspects the coin to determine if the correct

COIN MECHANISM

nism(s)

coin has been inserted.

COMPLEMENTARY

Having opposite states, such as the outputs of a flip-flop.

A repetitive timing signal for synchronizing

CLOCK

system functions. COINCIDENCE

A binary digit; expressed as 1 or 0.

BLANKING

BIT

Turning off the beam on a cathode-ray tube during retrace.

Horizontal and vertical synchronization pulses that are bused together into a single

COMPOSITE SYNC

signal. This signal provides the timing necessary to keep the display in synchroniza-

tion with the game circuitry.

COMPOSITE VIDEO

BLOCK DIAGRAM

A drawing in which functional circuitry units are represented by blocks. Very useful during initial

troubleshooting. BUFFER

nate the reaction of a driven circuit on the circuits driving it (e.g., a buffer amplifier).

2. A device used to supply additional drive capability. 1. An isolating circuit designed to elimi-

A device used to increase the strength of an applied signal.

The positive (arrow) end of a diode.

ANODE

AMPLIFIER

The maximum instantaneous value of a

AMPLITUDE

waveform pulse from zero.

ASTABLE

BUS

One play for one person based on the game

switch settings.

CREDIT

video.

Complete video signal from the game system to drive the display circuitry, usually comprising H SYNC, V SYNC, and the

An electrical path over which information is transferred from any of several sources to any of several destinations.

Cathode-ray tube.

DATA

CAPACITOR

Having no normal state. An astable device will free-run or oscillate as long as operating voltage is applied. The oscillation fre-

quency is usually controlled by external

AUXILIARY COIN SWITCH

circuitry

A device capable of storing electrical energy. A capacitor blocks the flow of DC current while allowing AC current to pass.

CATHODE

A momentary-contact pushbutton switch with a black cap located on the utility panel. The auxiliary coin switch adds credits to the game without activating a coin counter.

The negative end of a diode.

DARLINGTON cessing.

General term for the numbers, letters, and symbols that serve as input for device pro-

A two-transistor amplifier that provides extremely high gain.

Direct current, meaning current flowing in one direction and of a fixed value.

An integrated circuit comprising many circuits on a single wafer slice.

DEFLECTION YOKE

cathode-ray tube. One set of coils deflects the electron beam horizontally and the oth-Electromagnetic coils around the neck of a er set deflects the beam vertically.

DIAGNOSTICS

A programmed routine for checking circuitry. For example: the self-test is a diagnostic routine.

DIODE

A semiconductor device that conducts in

Non-integrated components, such as resisonly one direction. DISCRETE

tors, capacitors, and transistors.

Direct memory access. DMA is a process of accessing memory that bypasses the microprocessor logic. DMA is normally used for transferring data between the input/output ports and memory.

DOWN TIME

The period during which a game is malfunctioning or not operating correctly due to machine failure.

EAROM

Electrically alterable read-only memory (see be changed by the application of high volt-ROM). The EAROM is a memory that can

FLYBACK

A step-up transformer used in a display to provide the high voltage.

GATE

sponds only when a certain combination of pulses is present at the inputs. 1. A circuit with one output that re-

PAGE

2. A circuit in which one signal switches another signal on and off.

To control the passage of a pulse or signal.

HARNESS

A prefabricated assembly of insulated wires and terminals ready to be attached to a piece of equipment.

HEXADECIMAL

A number system using the equivalent of the decimal number 16 as a base. The symbols 0-9 and A-F are usually used.

1. A resistor that has a continuously moving contact which is generally mounted on a moving shaft. Used chiefly as a voltage di-

POTENTIOMETER

light source.

measuring a voltage

vider. Also called a pot (slang).

2. An instrument for measuri by balancing it against a knowr

a known voltage.

Random-access memory. A device for the

temporary storage of data.

RASTER-SCAN DISPLAY

IMPLODE

To burst inward; the inward collapse of a vacuum tube.

Input/Output.

Interrupt request. IRQ is a control signal to the microprocessor that is generated by external logic. This signal tells the micropro-

scanning the cath-

A display system whereby images are displayed by continuously scanning the cath-

Depending on the program, the processor cessor that external logic needs attention. may or may not respond.

ode-ray tube horizontally and vertically with

an electron beam. The display system controls the intensity of the electron beam.

The abbreviation for a

coin return box when light-emitting diode Directs coins into the LOCKOUT COIL

during which the cathode-ray tube electron beam is resetting either from right to left or

from bottom to top.

RESISTOR

In a raster-scan display, retrace is the time

there is no power to the game. LOGIC STATE

The binary (1 or 0) value at the node of a logic element or integrated circuit during a particular time. Also called the logic level. The list below shows the voltage levels corresponding to the logic states (levels) in a TTL system.

limit current flow or to provide a voltage

drop. ROM

A device designed to have a definite amount of resistance. Used in circuits to

Logic 0, Low = 0 VDC to +0.8 VDC Grey Area (Tri-State Level) =

Read-only memory. A device for the permanent storage of data.

A process of isolating digital logic faults at the component level by means of special test equipment

SIGNATURE ANALYSIS

+0.8 VDC to +2.4 VI

 $Logic\ 1,\ Higb=+2.4\ VDC\ to\ +5\ VDC$

MULTIPLEXER

cally, signature analyzers (e.g., the ATARI® CAT Box) convert

called signature analyzers. Basi-

lengthy bit streams into four-digit hexadecimal signatures. The signature read by the analyzer at

pared with the known good signature

each circuit node is then com-

for that node. This process continues

until a fault is located.

TROUBLESHOOT

speed data stream for simultaneous trans-A device that takes several low-speed inputs and combines them into one highmission on a single line

Non-maskable interrupt. NMI is a request for service by the microprocessor from external logic. The microprocessor cannot ignore this interrupt request.

A line segment drawn between specific X and Y coordinates on a cathode-ray tube. VECTOR

The process of locating and repairing a fault.

WATCHIDOG

A subsection of memory. A read-only mem-

called pages. Each block has X number of

bytes. PCB

ory device (see ROM) is broken into discrete blocks of data. These blocks are

tion does occur, the counter applies continprocessor, which causes the microprocessor program malfunction occurs. If a malfuncuous pulses to the reset line of the micro-A counter circuit designed to protect the microprocessor from self-destruction if a to keep resetting.

X-Y DISPLAY

A transistor that is activated by an external

printed-circuit board.

The abbreviation for a **PHOTOTRANSISTOR** A display system whereby images are displayed with vectors.

ZENER DIODE

A special diode used as a regulator. Its main characteristic is breaking down at a specified reverse-bias (Zener) voltage.



Statistics Sheet Rampart

Location:	
Recorded:	
Jate	

Meter:

Statistics Screen

Continued Game Minutes: Center Player Minutes: Right Player Minutes: New Game Minutes: Left Player Minutes: 2-Player Minutes: 1-Player Minutes: 3-Player Minutes: Auxiliary Coins: Active Minutes: Idle Minutes: Total Games: Right Coins: Left Coins:

1-Player Beginners:

Total Sessions:

sec. Average Time/Coin: 1-Player Advanced: Percentage Play: Total Coins: Error Count: